US010742340B2

(12) **United States Patent**
Raichelgauz et al.

(10) **Patent No.: US 10,742,340 B2**
(45) **Date of Patent: Aug. 11, 2020**

(54) **SYSTEM AND METHOD FOR IDENTIFYING THE CONTEXT OF MULTIMEDIA CONTENT ELEMENTS DISPLAYED IN A WEB-PAGE AND PROVIDING CONTEXTUAL FILTERS RESPECTIVE THERETO**

(71) Applicant: **CORTICA, LTD.**, Ramat Gan (IL)

(72) Inventors: **Igal Raichelgauz**, Ramat Gan (IL); **Karina Odinaev**, Ramat Gan (IL); **Yehoshua Y. Zeevi**, Haifa (IL)

(73) Assignee: **CORTICA LTD.**, Tel Aviv (IL)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 733 days.

(21) Appl. No.: **14/198,178**

(22) Filed: **Mar. 5, 2014**

(65) **Prior Publication Data**

US 2014/0188786 A1 Jul. 3, 2014

Related U.S. Application Data

(63) Continuation-in-part of application No. 13/624,397, filed on Sep. 21, 2012, now Pat. No. 9,191,626, which

(Continued)

(30) **Foreign Application Priority Data**

Oct. 26, 2005 (IL) 171577
Jan. 29, 2006 (IL) 173409
Aug. 21, 2007 (IL) 185414

(51) **Int. Cl.**
H04H 60/56 (2008.01)
H04H 60/37 (2008.01)
(Continued)

(52) **U.S. Cl.**
CPC ***H04H 60/56*** (2013.01); ***G06F 16/957*** (2019.01); ***G06Q 30/0251*** (2013.01);
(Continued)

(58) **Field of Classification Search**
CPC ... H04H 60/56; G06F 16/957; G06Q 30/0251
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,733,353 A 3/1988 Jaswa
4,932,645 A 6/1990 Schorey et al.
(Continued)

FOREIGN PATENT DOCUMENTS

EP 1085464 A3 1/2007
WO 02/31764 4/2002
(Continued)

OTHER PUBLICATIONS

M. Schneider et al., "A Robust Content Based Digital Signature for Image Authentication", Proc. ICIP 1996, Laussane, Switzerland, Oct. 1996.*

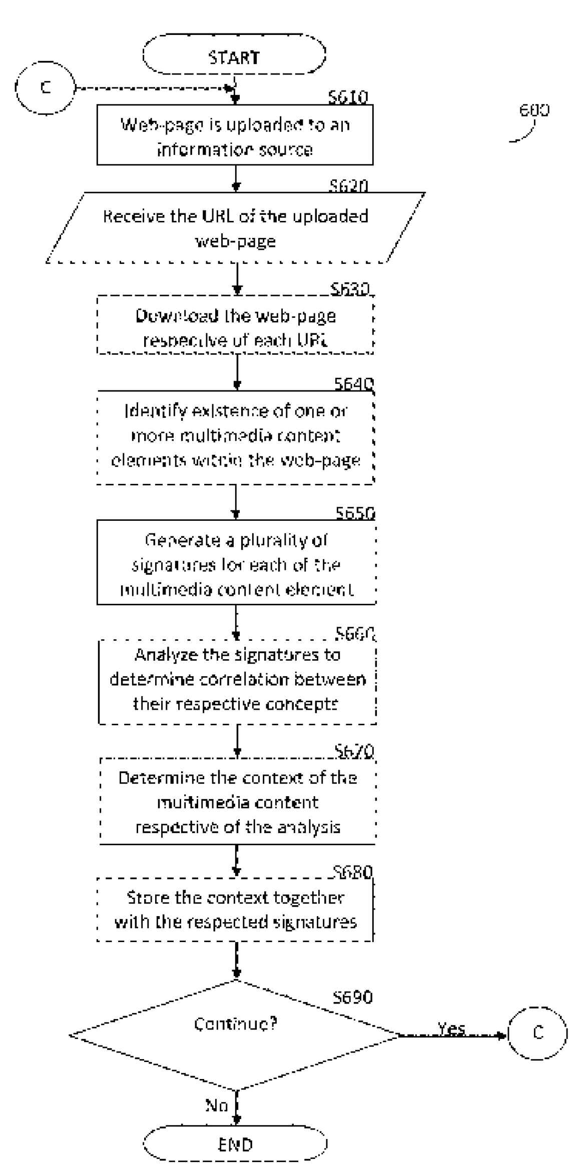
(Continued)

Primary Examiner — Daniel C Puentes
(74) *Attorney, Agent, or Firm* — Reches Patent

(57) **ABSTRACT**

A method and system for providing contextual filters respective of an identified context of a plurality of multimedia content elements are provided. The method comprises receiving the plurality of multimedia content elements; generating at least one signature for each of the plurality of multimedia content elements; determining a context of each of the plurality of multimedia content elements based on its respective at least one signature, wherein a context is determined as the correlation among a plurality of cluster of signatures; and providing at least one contextual filter respective of the context of each of the plurality of multimedia content elements.

24 Claims, 8 Drawing Sheets



Related U.S. Application Data

is a continuation-in-part of application No. 13/344,400, filed on Jan. 5, 2012, now Pat. No. 8,959,037, which is a continuation of application No. 12/434,221, filed on May 1, 2009, now Pat. No. 8,112,376, said application No. 13/624,397 is a continuation-in-part of application No. 12/084,150, filed as application No. PCT/IL2006/001235 on Oct. 26, 2006, now Pat. No. 8,655,801, said application No. 13/624,397 is a continuation-in-part of application No. 12/195,863, filed on Aug. 21, 2008, now Pat. No. 8,326,775, which is a continuation-in-part of application No. 12/084,150, filed on Apr. 7, 2009, now Pat. No. 8,655,801.

(60) Provisional application No. 61/773,349, filed on Mar. 6, 2013.

(51) **Int. Cl.**

H04N 21/258	(2011.01)
H04N 21/2668	(2011.01)
H04N 21/466	(2011.01)
H04H 60/47	(2008.01)
H04H 60/33	(2008.01)
H04N 7/173	(2011.01)
H04N 21/81	(2011.01)
G06Q 30/02	(2012.01)
G06F 16/957	(2019.01)

(52) **U.S. Cl.**

CPC ***H04H 60/33*** (2013.01); ***H04H 60/37*** (2013.01); ***H04H 60/47*** (2013.01); ***H04N 7/17318*** (2013.01); ***H04N 21/25891*** (2013.01); ***H04N 21/2668*** (2013.01); ***H04N 21/466*** (2013.01); ***H04N 21/8106*** (2013.01); *H04H 2201/90* (2013.01)

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,972,363 A 11/1990 Nguyen et al.
5,214,746 A 5/1993 Fogel et al.
5,307,451 A 4/1994 Clark
5,412,564 A 5/1995 Ecer
5,436,653 A 7/1995 Ellis et al.
5,568,181 A 10/1996 Greenwood et al.
5,638,425 A 6/1997 Meador, III et al.
5,745,678 A * 4/1998 Herzberg G06F 21/10 705/51
5,763,069 A 6/1998 Jordan
5,806,061 A 9/1998 Chaudhuri et al.
5,852,435 A 12/1998 Vigneaux et al.
5,870,754 A 2/1999 Dimitrova et al.
5,873,080 A 2/1999 Coden et al.
5,887,193 A 3/1999 Takahashi et al.
5,978,754 A 11/1999 Kumano
5,991,306 A 11/1999 Bums et al.
6,052,481 A 4/2000 Grajski et al.
6,070,167 A 5/2000 Qian et al.
6,076,088 A 6/2000 Paik et al.
6,122,628 A 9/2000 Castelli et al.
6,128,651 A 10/2000 Cezar
6,137,911 A 10/2000 Zhilyaev
6,144,767 A 11/2000 Bottou et al.
6,147,636 A 11/2000 Gershenson
6,163,510 A 12/2000 Lee et al.
6,243,375 B1 6/2001 Speicher
6,243,713 B1 6/2001 Nelson et al.
6,275,599 B1 8/2001 Adler et al.
6,329,986 B1 12/2001 Cheng
6,381,656 B1 4/2002 Shankman
6,411,229 B2 6/2002 Kobayashi
6,422,617 B1 7/2002 Fukumoto et al.
6,507,672 B1 1/2003 Watkins et al.
6,523,046 B2 2/2003 Liu et al.
6,524,861 B1 2/2003 Anderson
6,550,018 B1 4/2003 Abonamah et al.
6,557,042 B1 4/2003 He et al.
6,594,699 B1 7/2003 Sahai et al.
6,601,026 B2 7/2003 Appelt et al.
6,611,628 B1 8/2003 Sekiguchi et al.
6,618,711 B1 9/2003 Ananth
6,640,015 B1 10/2003 Lafruit
6,643,620 B1 11/2003 Contolini et al.
6,643,643 B1 11/2003 Lee et al.
6,665,657 B1 12/2003 Dibachi
6,681,032 B2 1/2004 Bortolussi et al.
6,704,725 B1 3/2004 Lee
6,732,149 B1 5/2004 Kephart
6,742,094 B2 5/2004 Igari
6,751,363 B1 6/2004 Natsev et al.
6,751,613 B1 6/2004 Lee et al.
6,754,435 B2 6/2004 Kim
6,763,069 B1 7/2004 Divakaran et al.
6,763,519 B1 7/2004 McColl et al.
6,774,917 B1 8/2004 Foote et al.
6,795,818 B1 9/2004 Lee
6,804,356 B1 10/2004 Krishnamachari
6,813,395 B1 11/2004 Kinjo
6,819,797 B1 11/2004 Smith et al.
6,845,374 B1 1/2005 Oliver et al.
6,877,134 B1 4/2005 Fuller et al.
6,901,207 B1 5/2005 Watkins
6,938,025 B1 8/2005 Lulich et al.
6,985,172 B1 1/2006 Rigney et al.
7,006,689 B2 2/2006 Kasutani
7,013,051 B2 3/2006 Sekiguchi et al.
7,020,654 B1 3/2006 Najmi
7,023,979 B1 4/2006 Wu et al.
7,043,473 B1 5/2006 Rassool et al.
7,047,033 B2 5/2006 Wyler
7,158,681 B2 1/2007 Persiantsev
7,199,798 B1 4/2007 Echigo et al.
7,215,828 B2 5/2007 Luo
7,260,564 B1 8/2007 Lynn et al.
7,277,928 B2 10/2007 Lennon
7,299,261 B1 11/2007 Oliver et al.
7,302,117 B2 11/2007 Sekiguchi et al.
7,313,805 B1 12/2007 Rosin et al.
7,340,358 B2 3/2008 Yoneyama
7,340,458 B2 3/2008 Vaithilingam et al.
7,353,224 B2 4/2008 Chen et al.
7,376,672 B2 5/2008 Weare
7,376,722 B1 5/2008 Sim et al.
7,433,895 B2 10/2008 Li et al.
7,464,086 B2 12/2008 Black et al.
7,526,607 B1 4/2009 Singh et al.
7,529,659 B2 5/2009 Wold
7,536,417 B2 5/2009 Walsh et al.
7,574,668 B2 8/2009 Nunez et al.
7,577,656 B2 8/2009 Kawai et al.
7,657,100 B2 2/2010 Gokturk et al.
7,660,468 B2 2/2010 Gokturk et al.
7,660,737 B1 2/2010 Lim et al.
7,694,318 B2 4/2010 Eldering et al.
7,697,791 B1 4/2010 Chan et al.
7,769,221 B1 8/2010 Shakes et al.
7,788,132 B2 8/2010 Desikan et al.
7,801,893 B2 9/2010 Gulli
7,836,054 B2 11/2010 Kawai et al.
7,837,111 B2 11/2010 Yang et al.
7,860,895 B1 12/2010 Scofield
7,904,503 B2 3/2011 Van De Sluis
7,920,894 B2 4/2011 Wyler
7,921,107 B2 4/2011 Chang et al.
7,933,407 B2 4/2011 Keidar et al.
7,974,881 B2 7/2011 Culver et al.
7,974,994 B2 7/2011 Li et al.
7,987,194 B1 7/2011 Walker et al.
7,987,217 B2 7/2011 Long et al.

(56) **References Cited**

U.S. PATENT DOCUMENTS

7,991,715	B2	8/2011	Schiff et al.
8,000,655	B2	8/2011	Wang et al.
8,023,739	B2	9/2011	Hohimer et al.
8,036,893	B2	10/2011	Reich
8,098,934	B2	1/2012	Vincent
8,112,376	B2 *	2/2012	Raichelgauz H04H 20/103 706/46
8,266,185	B2	9/2012	Raichelgauz et al.
8,275,764	B2	9/2012	Jeon
8,312,031	B2	11/2012	Raichelgauz et al.
8,315,442	B2	11/2012	Gokturk et al.
8,316,005	B2	11/2012	Moore
8,326,646	B2	12/2012	Schwarzberg et al.
8,326,775	B2 *	12/2012	Raichelgauz G06F 17/30595 706/10
8,345,982	B2	1/2013	Gokturk et al.
8,380,932	B1 *	2/2013	Martin G06F 17/30902 711/133
RE44,225	E	5/2013	Aviv
8,457,827	B1	6/2013	Ferguson et al.
8,495,489	B1	7/2013	Everingham
8,527,978	B1	9/2013	Sallam
8,548,828	B1	10/2013	Longmire
8,634,980	B1	1/2014	Urmson
8,635,531	B2	1/2014	Graham et al.
8,655,801	B2 *	2/2014	Raichelgauz G06N 3/063 706/12
8,655,878	B1	2/2014	Kulkarni et al.
8,677,377	B2	3/2014	Cheyer et al.
8,682,667	B2	3/2014	Haughay
8,688,446	B2	4/2014	Yanagihara
8,706,503	B2	4/2014	Cheyer et al.
8,775,442	B2	7/2014	Moore et al.
8,781,152	B2	7/2014	Momeyer
8,782,077	B1	7/2014	Rowley
8,799,195	B2	8/2014	Raichelgauz et al.
8,799,196	B2	8/2014	Raichelquaz et al.
8,818,916	B2	8/2014	Raichelgauz et al.
8,868,619	B2	10/2014	Raichelgauz et al.
8,868,861	B2	10/2014	Shimizu et al.
8,880,539	B2	11/2014	Raichelgauz et al.
8,880,566	B2	11/2014	Raichelgauz et al.
8,886,648	B1	11/2014	Procopio et al.
8,898,568	B2	11/2014	Bull et al.
8,922,414	B2	12/2014	Raichelgauz et al.
8,959,037	B2 *	2/2015	Raichelgauz H04H 20/103 706/10
8,990,125	B2	3/2015	Raichelgauz et al.
8,990,199	B1	3/2015	Ramesh et al.
9,009,086	B2	4/2015	Raichelgauz et al.
9,031,999	B2	5/2015	Raichelgauz et al.
9,087,049	B2	7/2015	Raichelgauz et al.
9,104,747	B2	8/2015	Raichelgauz et al.
9,165,406	B1	10/2015	Gray et al.
9,191,626	B2 *	11/2015	Raichelgauz H04H 20/103
9,197,244	B2	11/2015	Raichelgauz et al.
9,218,606	B2	12/2015	Raichelgauz et al.
9,235,557	B2	1/2016	Raichelgauz et al.
9,256,668	B2	2/2016	Raichelgauz et al.
9,298,763	B1	3/2016	Zack
9,323,754	B2	4/2016	Ramanathan et al.
9,330,189	B2	5/2016	Raichelgauz et al.
9,384,196	B2	7/2016	Raichelgauz et al.
9,438,270	B2	9/2016	Raichelgauz et al.
9,440,647	B1	9/2016	Sucan
9,466,068	B2	10/2016	Raichelgauz et al.
9,606,992	B2	3/2017	Geisner et al.
9,646,006	B2	5/2017	Raichelgauz et al.
9,679,062	B2	6/2017	Schillings et al.
9,734,533	B1	8/2017	Givot
9,807,442	B2	10/2017	Bhatia et al.
9,875,445	B2	1/2018	Amer et al.
9,984,369	B2	5/2018	Li et al.
10,133,947	B2	11/2018	Yang
10,347,122	B2	7/2019	Takenaka
10,491,885	B1	11/2019	Hicks
2001/0019633	A1	9/2001	Tenze
2001/0038876	A1	11/2001	Anderson
2001/0056427	A1	12/2001	Yoon et al.
2002/0010682	A1 *	1/2002	Johnson G06F 17/30864 705/59
2002/0010715	A1	1/2002	Chinn et al.
2002/0019881	A1	2/2002	Bokhari et al.
2002/0019882	A1	2/2002	Bokhani
2002/0032677	A1	3/2002	Morgenthaler et al.
2002/0037010	A1	3/2002	Yamauchi
2002/0038299	A1	3/2002	Zernik et al.
2002/0042914	A1	4/2002	Walker et al.
2002/0059580	A1	5/2002	Kalker et al.
2002/0072935	A1	6/2002	Rowse et al.
2002/0087530	A1	7/2002	Smith et al.
2002/0099870	A1 *	7/2002	Miller G11B 27/034 719/328
2002/0107827	A1	8/2002	Benitez-Jimenez et al.
2002/0113812	A1	8/2002	Walker et al.
2002/0123928	A1	9/2002	Eldering et al.
2002/0126872	A1	9/2002	Brunk et al.
2002/0129140	A1	9/2002	Peled et al.
2002/0129296	A1	9/2002	Kwiat et al.
2002/0143976	A1	10/2002	Barker et al.
2002/0147637	A1	10/2002	Kraft et al.
2002/0152267	A1	10/2002	Lennon
2002/0157116	A1	10/2002	Jasinschi
2002/0159640	A1	10/2002	Vaithilingam et al.
2002/0161739	A1 *	10/2002	Oh G06Q 30/02
2002/0163532	A1	11/2002	Thomas
2002/0174095	A1	11/2002	Lulich et al.
2002/0178410	A1	11/2002	Haitsma et al.
2002/0184505	A1	12/2002	Mihcak et al.
2003/0005432	A1	1/2003	Ellis et al.
2003/0028660	A1	2/2003	Igawa et al.
2003/0037010	A1	2/2003	Schmelzer
2003/0041047	A1	2/2003	Chang et al.
2003/0050815	A1 *	3/2003	Seigel G06F 17/3087 705/26.41
2003/0078766	A1	4/2003	Appelt et al.
2003/0086627	A1	5/2003	Berriss et al.
2003/0089216	A1	5/2003	Birmingham et al.
2003/0093790	A1	5/2003	Logan et al.
2003/0101150	A1	5/2003	Agnihotri
2003/0105739	A1 *	6/2003	Essafi G06F 21/64
2003/0115191	A1	6/2003	Copperman et al.
2003/0126147	A1	7/2003	Essafi et al.
2003/0182567	A1 *	9/2003	Barton H04H 60/27 713/193
2003/0184598	A1	10/2003	Graham
2003/0191764	A1	10/2003	Richards
2003/0200217	A1	10/2003	Ackerman
2003/0217335	A1	11/2003	Chung et al.
2003/0229531	A1	12/2003	Heckerman et al.
2004/0003394	A1	1/2004	Ramaswamy
2004/0025180	A1	2/2004	Begeja et al.
2004/0059736	A1	3/2004	Willse
2004/0068510	A1	4/2004	Hayes et al.
2004/0091111	A1	5/2004	Levy
2004/0095376	A1	5/2004	Graham et al.
2004/0098671	A1	5/2004	Graham et al.
2004/0107181	A1	6/2004	Rodden
2004/0111432	A1	6/2004	Adams et al.
2004/0111465	A1	6/2004	Chuang et al.
2004/0117367	A1	6/2004	Smith et al.
2004/0117638	A1	6/2004	Monroe
2004/0128142	A1	7/2004	Whitham
2004/0128511	A1 *	7/2004	Sun H04L 9/3247 713/176
2004/0133927	A1	7/2004	Sternberg et al.
2004/0153426	A1	8/2004	Nugent
2004/0215663	A1	10/2004	Liu et al.
2004/0230572	A1	11/2004	Omoigui
2004/0249779	A1	12/2004	Nauck et al.
2004/0260688	A1	12/2004	Gross
2004/0267774	A1	12/2004	Lin et al.
2005/0021394	A1	1/2005	Miedema et al.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2005/0114198 A1 5/2005 Koningstein et al.
2005/0131884 A1 6/2005 Gross et al.
2005/0144455 A1 6/2005 Haitsma
2005/0163375 A1 7/2005 Grady
2005/0172130 A1* 8/2005 Roberts G06F 21/64 713/176
2005/0177372 A1 8/2005 Wang et al.
2005/0193015 A1 9/2005 Logston
2005/0238198 A1 10/2005 Brown et al.
2005/0238238 A1* 10/2005 Xu G06F 16/7834 382/224
2005/0245241 A1* 11/2005 Durand G06Q 30/02 455/414.1
2005/0249398 A1 11/2005 Khamene et al.
2005/0256820 A1 11/2005 Dugan et al.
2005/0262428 A1 11/2005 Little et al.
2005/0281439 A1 12/2005 Lange
2005/0289163 A1 12/2005 Gordon et al.
2005/0289590 A1 12/2005 Cheok et al.
2006/0004745 A1 1/2006 Kuhn et al.
2006/0013451 A1 1/2006 Haitsma
2006/0020860 A1 1/2006 Tardif et al.
2006/0020958 A1 1/2006 Allamanche et al.
2006/0026203 A1 2/2006 Tan et al.
2006/0031216 A1 2/2006 Semple et al.
2006/0033163 A1 2/2006 Chen
2006/0041596 A1 2/2006 Stirbu et al.
2006/0048191 A1 3/2006 Xiong
2006/0064037 A1 3/2006 Shalon et al.
2006/0100987 A1 5/2006 Leurs
2006/0112035 A1 5/2006 Cecchi et al.
2006/0120626 A1 6/2006 Perlmutter
2006/0129822 A1* 6/2006 Snijder H04H 60/56 713/176
2006/0143674 A1 6/2006 Jones et al.
2006/0153296 A1 7/2006 Deng
2006/0159442 A1 7/2006 Kim et al.
2006/0173688 A1 8/2006 Whitham
2006/0184638 A1 8/2006 Chua et al.
2006/0204035 A1 9/2006 Guo et al.
2006/0217818 A1 9/2006 Fujiwara
2006/0217828 A1 9/2006 Hicken
2006/0218191 A1 9/2006 Gopalakrishnan
2006/0224529 A1 10/2006 Kermani
2006/0236343 A1 10/2006 Chang
2006/0242130 A1 10/2006 Sadri et al.
2006/0242139 A1 10/2006 Butterfield et al.
2006/0242554 A1 10/2006 Gerace et al.
2006/0247983 A1* 11/2006 Dalli G06F 17/27 705/26.1
2006/0248558 A1* 11/2006 Barton H04H 60/27 725/46
2006/0251339 A1 11/2006 Gokturk
2006/0253423 A1 11/2006 McLane et al.
2006/0288002 A1 12/2006 Epstein et al.
2007/0019864 A1 1/2007 Koyama et al.
2007/0022374 A1 1/2007 Huang et al.
2007/0033163 A1 2/2007 Epstein et al.
2007/0038614 A1 2/2007 Guha
2007/0042757 A1 2/2007 Jung et al.
2007/0061302 A1 3/2007 Ramer et al.
2007/0067304 A1 3/2007 Ives
2007/0067682 A1* 3/2007 Fang G06F 21/565 714/100
2007/0071330 A1 3/2007 Oostveen et al.
2007/0074147 A1 3/2007 Wold
2007/0083611 A1 4/2007 Farago et al.
2007/0091106 A1 4/2007 Moroney
2007/0124796 A1* 5/2007 Wittkotter H04N 7/17309 725/136
2007/0130159 A1 6/2007 Gulli et al.
2007/0156720 A1 7/2007 Maren
2007/0168413 A1 7/2007 Barletta et al.
2007/0179359 A1 8/2007 Goodwin
2007/0195987 A1 8/2007 Rhoads
2007/0196013 A1 8/2007 Li
2007/0220573 A1 9/2007 Chiussi et al.
2007/0233701 A1* 10/2007 Sherwood G06F 17/30029
2007/0244902 A1 10/2007 Seide et al.
2007/0253594 A1 11/2007 Lu et al.
2007/0255785 A1 11/2007 Hayashi et al.
2007/0294295 A1 12/2007 Finkelstein et al.
2007/0298152 A1 12/2007 Baets
2008/0040277 A1 2/2008 Dewitt
2008/0046406 A1 2/2008 Seide et al.
2008/0049629 A1 2/2008 Morrill
2008/0049789 A1 2/2008 Vedantham et al.
2008/0072256 A1 3/2008 Boicey et al.
2008/0079729 A1 4/2008 Brailovsky
2008/0091527 A1 4/2008 Silverbrook et al.
2008/0109433 A1 5/2008 Rose
2008/0152231 A1 6/2008 Gokturk
2008/0159622 A1 7/2008 Agnihotri et al.
2008/0163288 A1 7/2008 Ghosal et al.
2008/0165861 A1 7/2008 Wen
2008/0166020 A1 7/2008 Kosaka
2008/0168135 A1* 7/2008 Redlich G06Q 10/10 709/204
2008/0201299 A1 8/2008 Lehikoinen et al.
2008/0201314 A1 8/2008 Smith et al.
2008/0201361 A1 8/2008 Castro et al.
2008/0204706 A1 8/2008 Magne et al.
2008/0228995 A1 9/2008 Tan et al.
2008/0237359 A1 10/2008 Silverbrook et al.
2008/0253737 A1 10/2008 Kimura
2008/0263579 A1 10/2008 Mears et al.
2008/0270373 A1 10/2008 Oostveen et al.
2008/0270569 A1 10/2008 McBride
2008/0294278 A1 11/2008 Borgeson
2008/0307454 A1 12/2008 Ahanger et al.
2008/0313127 A1* 12/2008 Wong G06F 17/30035 706/61
2008/0313140 A1 12/2008 Pereira et al.
2009/0013414 A1 1/2009 Washington et al.
2009/0022472 A1* 1/2009 Bronstein G06K 9/00751 386/278
2009/0024641 A1 1/2009 Quigley et al.
2009/0034791 A1 2/2009 Doretto
2009/0043637 A1 2/2009 Eder
2009/0043818 A1* 2/2009 Raichelgauz G06F 17/30595
2009/0080759 A1 3/2009 Bhaskar
2009/0089587 A1 4/2009 Brunk et al.
2009/0119157 A1 5/2009 Dulepet
2009/0125529 A1 5/2009 Vydiswaran et al.
2009/0125544 A1 5/2009 Brindley
2009/0148045 A1 6/2009 Lee et al.
2009/0157575 A1 6/2009 Schobben et al.
2009/0165031 A1* 6/2009 Li G06F 21/10 725/22
2009/0172030 A1 7/2009 Schiff et al.
2009/0175538 A1 7/2009 Bronstein et al.
2009/0204511 A1 8/2009 Tsang
2009/0208106 A1 8/2009 Dunlop et al.
2009/0216639 A1 8/2009 Kapczynski et al.
2009/0216761 A1* 8/2009 Raichelgauz H04H 20/103
2009/0220138 A1 9/2009 Zhang et al.
2009/0245573 A1 10/2009 Saptharishi et al.
2009/0245603 A1 10/2009 Koruga et al.
2009/0253583 A1 10/2009 Yoganathan
2009/0254572 A1* 10/2009 Redlich G06Q 10/06
2009/0259687 A1 10/2009 Mai et al.
2009/0277322 A1 11/2009 Cai et al.
2009/0278934 A1 11/2009 Ecker
2009/0282218 A1 11/2009 Raichelgauz et al.
2009/0297048 A1 12/2009 Slotine et al.
2009/0313305 A1* 12/2009 Raichelgauz G06F 17/30017
2010/0010968 A1* 1/2010 Redlich G06F 17/30672 707/E17.014
2010/0023400 A1 1/2010 Dewitt
2010/0042646 A1 2/2010 Raichelgauz
2010/0082684 A1* 4/2010 Churchill G06F 17/30867 707/784
2010/0088321 A1 4/2010 Soloman et al.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2010/0104184 A1 4/2010 Bronstein
2010/0106857 A1 4/2010 Wyler
2010/0111408 A1 5/2010 Matsuhira
2010/0125569 A1 5/2010 Nair
2010/0153201 A1 6/2010 De Rubertis et al.
2010/0153209 A1 6/2010 De Rubertis et al.
2010/0162405 A1 6/2010 Cook
2010/0173269 A1 7/2010 Puri et al.
2010/0191567 A1 7/2010 Lee et al.
2010/0198626 A1 8/2010 Cho et al.
2010/0250497 A1* 9/2010 Redlich F41H 13/00 707/661
2010/0268524 A1 10/2010 Nath et al.
2010/0284604 A1 11/2010 Chrysanthakopoulos
2010/0306193 A1 12/2010 Pereira
2010/0312736 A1 12/2010 Kello
2010/0317420 A1* 12/2010 Hoffberg G06Q 30/0207 463/1
2010/0318493 A1 12/2010 Wessling
2010/0322522 A1 12/2010 Wang et al.
2010/0325138 A1* 12/2010 Lee G06F 17/30873 707/759
2010/0325581 A1 12/2010 Finkelstein et al.
2011/0029620 A1 2/2011 Bonforte
2011/0035289 A1 2/2011 King et al.
2011/0038545 A1 2/2011 Bober
2011/0052063 A1 3/2011 McAuley et al.
2011/0055585 A1 3/2011 Lee
2011/0106782 A1 5/2011 Ke et al.
2011/0145068 A1 6/2011 King et al.
2011/0164180 A1 7/2011 Lee
2011/0164810 A1 7/2011 Zang et al.
2011/0202848 A1 8/2011 Ismalon
2011/0208822 A1 8/2011 Rathod
2011/0218946 A1 9/2011 Stern et al.
2011/0246566 A1 10/2011 Kashef
2011/0251896 A1 10/2011 Impollonia et al.
2011/0276680 A1 11/2011 Rimon
2011/0296315 A1 12/2011 Lin et al.
2011/0313856 A1 12/2011 Cohen et al.
2012/0082362 A1 4/2012 Diem et al.
2012/0131454 A1 5/2012 Shah
2012/0133497 A1 5/2012 Sasaki
2012/0150890 A1 6/2012 Jeong et al.
2012/0167133 A1* 6/2012 Carroll G06Q 30/0251 725/32
2012/0179642 A1 7/2012 Sweeney et al.
2012/0179751 A1 7/2012 Ahn
2012/0185445 A1 7/2012 Borden et al.
2012/0197857 A1 8/2012 Huang
2012/0221470 A1 8/2012 Lyon
2012/0227074 A1 9/2012 Hill et al.
2012/0239690 A1 9/2012 Asikainen et al.
2012/0239694 A1 9/2012 Avner et al.
2012/0299961 A1 11/2012 Ramkumar et al.
2012/0301105 A1 11/2012 Rehg et al.
2012/0330869 A1 12/2012 Durham
2012/0331011 A1 12/2012 Raichelgauz et al.
2013/0018736 A1* 1/2013 Raichelgauz H04H 20/103 705/14.73
2013/0031489 A1 1/2013 Gubin et al.
2013/0066856 A1 3/2013 Ong et al.
2013/0067035 A1 3/2013 Amanat et al.
2013/0067364 A1 3/2013 Berntson et al.
2013/0080433 A1 3/2013 Raichelgauz et al.
2013/0080868 A1* 3/2013 Raichelgauz G06F 17/2235 715/205
2013/0086499 A1 4/2013 Dyor et al.
2013/0089248 A1 4/2013 Remiszewski
2013/0103814 A1 4/2013 Carrasco
2013/0104251 A1 4/2013 Moore et al.
2013/0159298 A1 6/2013 Mason et al.
2013/0173635 A1 7/2013 Sanjeev
2013/0191323 A1* 7/2013 Raichelgauz G06F 17/30592 707/603
2013/0191368 A1* 7/2013 Raichelgauz G06F 17/30023 707/713
2013/0212493 A1 8/2013 Krishnamurthy
2013/0226820 A1 8/2013 Sedota, Jr.
2013/0226930 A1 8/2013 Amgren et al.
2013/0227023 A1* 8/2013 Raichelgauz H04H 60/31 709/204
2013/0283401 A1 10/2013 Pabla et al.
2013/0325550 A1 12/2013 Varghese et al.
2013/0332951 A1 12/2013 Gharaat et al.
2014/0019264 A1 1/2014 Wachman et al.
2014/0025692 A1 1/2014 Pappas
2014/0059443 A1 2/2014 Tabe
2014/0095425 A1 4/2014 Sipple
2014/0111647 A1 4/2014 Atsmon
2014/0125703 A1 5/2014 Roveta
2014/0147829 A1 5/2014 Jerauld
2014/0152698 A1 6/2014 Kim et al.
2014/0169681 A1 6/2014 Drake
2014/0176604 A1 6/2014 Venkitaraman et al.
2014/0188786 A1* 7/2014 Raichelgauz H04H 60/37 707/602
2014/0193077 A1 7/2014 Shiiyama et al.
2014/0201330 A1 7/2014 Lozano Lopez
2014/0250032 A1 9/2014 Huang et al.
2014/0282655 A1 9/2014 Roberts
2014/0300722 A1 10/2014 Garcia
2014/0310825 A1* 10/2014 Raichelgauz G06F 21/629 726/30
2014/0330830 A1 11/2014 Raichelgauz et al.
2014/0341476 A1 11/2014 Kulick et al.
2014/0379477 A1 12/2014 Sheinfeld
2015/0033150 A1 1/2015 Lee
2015/0100562 A1 4/2015 Kohlmeier et al.
2015/0117784 A1 4/2015 Lin
2015/0120627 A1 4/2015 Hunzinger et al.
2015/0134688 A1 5/2015 Jing
2015/0154189 A1 6/2015 Raichelgauz et al.
2015/0254344 A1 9/2015 Kulkarni et al.
2015/0286742 A1 10/2015 Zhang et al.
2015/0289022 A1 10/2015 Gross
2015/0324356 A1 11/2015 Gutierrez et al.
2015/0363644 A1 12/2015 Wnuk
2016/0007083 A1 1/2016 Gurha
2016/0026707 A1 1/2016 Ong et al.
2016/0210525 A1 7/2016 Yang
2016/0221592 A1 8/2016 Puttagunta
2016/0239566 A1 8/2016 Raichelgauz et al.
2016/0306798 A1 10/2016 Guo et al.
2016/0342683 A1 11/2016 Kwon
2016/0357188 A1 12/2016 Ansari
2017/0017638 A1 1/2017 Satyavarta et al.
2017/0032257 A1 2/2017 Sharifi
2017/0041254 A1 2/2017 Agara Venkatesha Rao
2017/0109602 A1 4/2017 Kim
2017/0154241 A1 6/2017 Shambik et al.
2017/0255620 A1 9/2017 Raichelgauz
2017/0262437 A1 9/2017 Raichelgauz
2017/0323568 A1 11/2017 Inoue
2018/0081368 A1 3/2018 Watanabe
2018/0101177 A1 4/2018 Cohen
2018/0157916 A1 6/2018 Doumbouya
2018/0158323 A1 6/2018 Takenaka
2018/0204111 A1 7/2018 Zadeh
2019/0005726 A1 1/2019 Nakano
2019/0039627 A1 2/2019 Yamamoto
2019/0043274 A1 2/2019 Hayakawa
2019/0045244 A1 2/2019 Balakrishnan
2019/0056718 A1 2/2019 Satou
2019/0065951 A1 2/2019 Luo
2019/0188501 A1 6/2019 Ryu
2019/0220011 A1 7/2019 Della Penna
2019/0317513 A1 10/2019 Zhang
2019/0364492 A1 11/2019 Azizi
2019/0384303 A1 12/2019 Muller
2019/0384312 A1 12/2019 Herbach
2019/0385460 A1 12/2019 Magzimof

(56) **References Cited**

U.S. PATENT DOCUMENTS

2019/0389459	A1	12/2019	Berntorp
2020/0004248	A1	1/2020	Healey
2020/0004251	A1	1/2020	Zhu
2020/0004265	A1	1/2020	Zhu
2020/0005631	A1	1/2020	Visintainer
2020/0018606	A1	1/2020	Wolcott
2020/0018618	A1	1/2020	Ozog
2020/0020212	A1	1/2020	Song
2020/0050973	A1	2/2020	Stenneth
2020/0073977	A1	3/2020	Montemerlo
2020/0090484	A1	3/2020	Chen
2020/0097756	A1	3/2020	Hashimoto
2020/0133307	A1	4/2020	Kelkar
2020/0043326	A1	6/2020	Tao

FOREIGN PATENT DOCUMENTS

WO	0231764	A2	4/2002
WO	2003005242	A1	1/2003
WO	2003067467	A1	8/2003
WO	WO 2004019527	A1 *	3/2004
WO	2005027457	A1	3/2005
WO	WO 2005027457	A1 *	3/2005
WO	2007/0049282		5/2007
WO	2007049282	A2	5/2007
WO	2014137337	A1	9/2014
WO	2016040376	A1	3/2016
WO	2016070193	A1	5/2016

OTHER PUBLICATIONS

C-Y. Lin et al., "Generating Robust Digital Signature for Image/Video Authentication", Multimedia and Security Workshop at ACM Multimedia 1998, Bristol England, Sep. 1998.*

M. P. Queluz, "Content Based Integrity Protection of Digital Images", SPIE Conf. on Security and Watermarking of Multimedia Contents, San Jose, Jan. 1999.*

Wang J.Z. et al, "Classifying objectionable websites based on image content," IDMS (1998) 113-124, 1998.*

Gomes et al., "Audio Watermaking and Fingerprinting: For Which Applications?" University of Rene Descartes, Paris, France, 2003.

Nam, et al., "Audio Visual Content-Based Violent Scene Characterization", Department of Electrical and Computer Engineering, Minneapolis, MN, 1998, pp. 353-357.

Zhu et al., Technology-Assisted Dietary Assessment. Computational Imaging VI, edited by Charles A. Bouman, Eric L. Miller, Ilya Pollak, Proc. of SPIE-IS&T Electronic Imaging, SPIE vol. 6814, 681411, Copyright 2008 SPIE-IS&T. pp. 1-10.

Verstraeten et al., "Isolated word recognition with the Liquid State Machine: a case study"; Department of Electronics and Information Systems, Ghent University, Sint-Pietersnieuwstraat 41, 9000 Gent, Belgium, Available online Jul. 14, 2005.

Zhou et al., "Medical Diagnosis With C4.5 Rule Preceded by Artificial Neural Network Ensemble"; IEEE Transactions on Information Technology in Biomedicine, vol. 7, Issue: 1, pp. 37-42, Date of Publication: Mar. 2003.

Cernansky et al., "Feed-forward Echo State Networks"; Proceedings of International Joint Conference on Neural Networks, Montreal, Canada, Jul. 31-Aug. 4, 2005.

Lyon, Richard F.; "Computational Models of Neural Auditory Processing"; IEEE International Conference on Acoustics, Speech, and Signal Processing, ICASSP '84, Date of Conference: Mar. 1984, vol. 9, pp. 41-44.

Zhou et al., "Ensembling neural networks: Many could be better than all"; National Laboratory for Novel Software Technology, Nanjing Unviersirty, Hankou Road 22, Nanjing 210093, PR China; Received Nov. 16, 2001, Available online Mar. 12, 2002.

Fathy et al., "A Parallel Design and Implementation for Backpropagation Neural Network Using NIMD Architecture", 8th Mediterranean Electrotechnical Corsfe rersce, 19'96. MELECON '96, Date of Conference: May 13-16, 1996, vol. 3, pp. 1472-1475.

Howlett et al., "A Multi-Computer Neural Network Architecture in a Virtual Sensor System Application", International Journal of Knowledge-based Intelligent Engineering Systems, 4 (2). pp. 86-93, 133N 1327-2314; first submitted Nov. 30, 1999; revised version submitted Mar. 10, 2000.

Ortiz-Boyer et al., "CIXL2: A Crossover Operator for Evolutionary Algorithms Based on Population Features", Journal of Artificial Intelligence Research 24 (2005) 1-48 Submitted Nov. 4; published Jul. 5.

IPO Examination Report under Section 18(3) for corresponding UK application No. GB1001219.3, dated May 30, 2012.

IPO Examination Report under Section 18(3) for corresponding UK application No. GB1001219.3, dated Sep. 12, 2011.

Lin, C.; Chang, S.: "Generating Robust Digital Signature for Image/Video Authentication", Multimedia and Security Workshop at ACM Mutlimedia '98; Bristol, U.K., Sep. 1998; pp. 49-54.

Iwamoto, K.; Kasutani, E.; Yamada, A.: "Image Signature Robust to Caption Superimposition for Video Sequence Identification"; 2006 IEEE International Conference on Image Processing; pp. 3185-3188, Oct. 8-11, 2006; doi: 10.1109/ICIP.2006.313046.

Maass, W. et al.: "Computational Models for Generic Cortical Microcircuits", Institute for Theoretical Computer Science, Technische Universitaet Graz, Graz, Austria, published Jun. 10, 2003.

International Search Report for the corresponding International Patent Application PCT/IL2006/001235; dated Nov. 2, 2008.

Raichelgauz, I. et al.: "Co-evolutionary Learning in Liquid Architectures", Lecture Notes in Computer Science, [Online] vol. 3512, Jun. 21, 2005 (Jun. 21, 2005), pp. 241-248, XP019010280 Springer Berlin/Heidelberg ISSN: 1611-3349 ISBN: 978-3-540-26208-4.

Jaeger, H.: "The "echo state" approach to analysing and training recurrent neural networks", GMD Report, No. 148, 2001, pp. 1-43, XP002466251. German National Research Center for Information Technology.

Verstraeten et al.: "Isolated word recognition with the Liquid State Machine: a case study", Information Processing Letters, Amsterdam, NL, vol. 95, No. 6, Sep. 30, 2005 (Sep. 30, 2005), pp. 521-528, XP005028093 ISSN: 0020-0190.

Zeevi, Y. et al.: "Natural Signal Classification by Neural Cliques and Phase-Locked Attractors", IEEE World Congress on Computational Intelligence, IJCNN2006, Vancouver, Canada, Jul. 2006 (Jul. 2006), XP002466252.

Natsclager, T. et al.: "The "liquid computer": a novel strategy for real-time computing on time series", Special Issue on Foundations of Information Processing of Telematik, vol. 8, No. 1, 2002, pp. 39-43, XP002466253.

Morad, T.Y. et al.: "Performance, Power Efficiency and Scalability of Asymmetric Cluster Chip Multiprocessors", Computer Architecture Letters, vol. 4, Jul. 4, 2005 (Jul. 4, 2005), pp. 1-4, XP002466254.

International Search Authority: "Written Opinion of the International Searching Authority" (PCT Rule 43bis.1) including International Search Report for International Patent Application No. PCT/US2008/073852; dated Jan. 28, 2009.

Xian-Sheng Hua et al.: "Robust Video Signature Based on Ordinal Measure" In: 2004 International Conference on Image Processing, ICIP '04; Microsoft Research Asia, Beijing, China; published Oct. 24-27, 2004, pp. 685-688.

International Search Authority: International Preliminary Report on Patentability (Chapter I of the Patent Cooperation Treaty) including "Written Opinion of the International Searching Authority" (PCT Rule 43bis. 1) for the corresponding International Patent Application No. PCT/IL2006/001235; dated Jul. 28, 2009.

Clement, et al. "Speaker Diarization of Heterogeneous Web Video Files: A Preliminary Study", Acoustics, Speech 3nd Signal Processing (ICASSP), 2011, IEEE International Conference on Year: 2011, pp. 4432-4435, DOI: 10.1109/ICASSP.2011.5947337 IEEE Conference Publications, France.

Gong, et al., "A Knowledge-based Mediator for Dynamic Integration of Heterogeneous Multimedia Information Sources", Video and Speech Processing, 2004, Proceedings of 2004 International Symposium on Year: 2004, pp. 167-470, DOI: 10.1109/ISIMP.2004.1434102 IEEE Conference Publications, Hong Kong.

(56) **References Cited**

OTHER PUBLICATIONS

Lin, et al., "Summarization of Large Scale Social Network Activity", Acoustics, Speech and Signal Processing, 2009, ICASSP 2009, IEEE International Conference on Year 2009, pp. 3481-3484, DOI: 10.1109/ICASSP.2009.4960375, IEEE Conference Publications, Arizona.
Liu, et al., "Instant Mobile Video Search With Layered Audio-Video Indexing and Progressive Transmission", Multimedia, IEEE Transactions on Year: 2014, vol. 16, Issue: 8, pp. 2242-2255, DOI: 10.1109/TMM.20142359332 IEEE Journals & Magazines.
Mladenovic, et al., "Electronic Tour Guide for Android Mobile Platform with Multimedia Travel Book", Telecommunications Forum (TELFOR), 2012 20th Year: 2012, pp. 1460-1463, DOI: 10.1109/TELFOR.2012.6419494 IEEE Conference Publications.
Nouza, et al., "Large-scale Processing, Indexing and Search System for Czech Audio-Visual Heritage Archives", Multimedia Signal Processing (MMSP), 2012, pp. 337-342, IEEE 14th Intl. Workshop, DOI: 10.1109/MMSP.2012.6343465, Czech Republic.
Park, et al., "Compact Video Signatures for Near-Duplicate Detection on Mobile Devices", Consumer Electronics (ISCE 2014), The 18th IEEE International Symposium on Year: 2014, pp. 1-2, DOI: 10.1109/ISCE.2014.6884293 IEEE Conference Publications.
Wang et al. "A Signature for Content-based Image Retrieval Using a Geometrical Transform", ACM 1998, pp. 229-234.
Zang, et al., "A New Multimedia Message Customizing Framework for Mobile Devices", Multimedia and Expo, 2007 IEEE International Conference on Year: 2007, pp. 1043-1046, DOI: 10.1109/ICME.2007.4284832 IEEE Conference Publications.
Li, et al., "Matching Commercial Clips from TV Streams Using a Unique, Robust and Compact Signature," Proceedings of the Digital Imaging Computing: Techniques and Applications, Feb. 2005, vol. 0-7695-2467, Australia.
Lin, et al., "Robust Digital Signature for Multimedia Authentication: A Summary", IEEE Circuits and Systems Magazine, 4th Quarter 2003, pp. 23-26.
May et al., "The Transputer", Springer-Verlag, Berlin Heidelberg, 1989, teaches multiprocessing system.
Vailaya, et al., "Content-Based Hierarchical Classification of Vacation Images," I.E.E.E: Multimedia Computing and Systems, vol. 1, 1999, East Lansing, MI, pp. 518-523.
Vallet, et al., "Personalized Content Retrieval in Context Using Ontological Knowledge," IEEE Transactions on Circuits and Systems for Video Technology, vol. 17, No. 3, Mar. 2007, pp. 336-346.
Whitby-Strevens, "The Transputer", 1985 IEEE, Bristol, UK.
Yanai, "Generic Image Classification Using Visual Knowledge on the Web," MM'03, Nov. 2-8, 2003, Tokyo, Japan, pp. 167-176.
Semizarov et al. "Specificity of Short Interfering RNA Determined through Gene Expression Signatures", PNAS, 2003, pp. 6347-6352.
Boari et al, "Adaptive Routing for Dynamic Applications in Massively Parallel Architectures", 1995 IEEE, Spring 1995.
Cococcioni, et al, "Automatic Diagnosis of Defects of Rolling Element Bearings Based on Computational Intelligence Techniques", University of Pisa, Pisa, Italy, 2009.
Emami, et al, "Role of Spatiotemporal Oriented Energy Features for Robust Visual Tracking in Video Surveillance, University of Queensland", St. Lucia, Australia, 2012.
Foote, Jonathan, et al. "Content-Based Retrieval of Music and Audio", 1997 Institute of Systems Science, National University of Singapore, Singapore (Abstract).
Guo et al, "AdOn: An Intelligent Overlay Video Advertising System", SIGIR, Boston, Massachusetts, Jul. 19-23, 2009.
Mandhaoui, et al, "Emotional Speech Characterization Based on Multi-Features Fusion for Face-to-Face Interaction", Universite Pierre et Marie Curie, Paris, France, 2009.
Marti, et al, "Real Time Speaker Localization and Detection System for Camera Steering in Multiparticipant Videoconferencing Environments", Universidad Politecnica de Valencia, Spain, 2011.
Mei, et al., "Contextual In-Image Advertising", Microsoft Research Asia, pp. 439-448, 2008.
Mei, et al., "VideoSense—Towards Effective Online Video Advertising", Microsoft Research Asia, pp. 1075-1084, 2007.
Nagy et al, "A Transputer, Based, Flexible, Real-Time Control System for Robotic Manipulators", UKACC International Conference on CONTROL '96, Sep. 2-5, 1996, Conference 1996, Conference Publication No. 427, IEE 1996.
Ribert et al. "An Incremental Hierarchical Clustering", Visicon Interface 1999, pp. 586-591.
Scheper et al, "Nonlinear dynamics in neural computation", ESANN'2006 proceedings—European Symposium on Artificial Neural Networks, Bruges (Belgium), Apr. 26-28, 2006, d-side publi, ISBN 2-930307-06-4.
Theodoropoulos et al, "Simulating Asynchronous Architectures on Transputer Networks", Proceedings of the Fourth Euromicro Workshop on Parallel and Distributed Processing, 1996. PDP '96.
Lau, et al., "Semantic Web Service Adaptation Model for a Pervasive Learning Scenario", 2008 IEEE Conference on Innovative Technologies in Intelligent Systems and Industrial Applications Year: 2008, pp. 98-103, DOI: 10.1109/CITISIA.2008.4607342 IEEE Conference Publications.
McNamara, et al., "Diversity Decay in Opportunistic Content Sharing Systems", 2011 IEEE International Symposium on a World of Wireless, Mobile and Multimedia Networks Year: 2011, pp. 1-3, DOI: 10.1109/WoWMoM.2011.5986211 IEEE Conference Publications.
Santos, et al., "SCORM-MPEG: an Ontology of Interoperable Metadata for Multimedia and e-Learning", 2015 23rd International Conference on Software, Telecommunications and Computer Networks (SoftCOM) Year: 2015, pp. 224-228, DOI: 10.1109/SOFTCOM.2015.7314122 IEEE Conference Publications.
Wilk, et al., "The Potential of Social-Aware Multimedia Prefetching on Mobile Devices", 2015 International Conference and Workshops on Networked Systems (NetSys) Year: 2015, pp. 1-5, DOI: 10.1109/NetSys.2015.7089081 IEEE Conference Publications.
Brecheisen, et al., "Hierarchical Genre Classification for Large Music Collections", ICME 2006, pp. 1385-1388.
Chuan-Yu Cho, et al., "Efficient Motion-Vector-Based Video Search Using Query by Clip", 2004, IEEE, Taiwan, pp. 1-4.
Ihab Al Kabary, et al., "SportSense: Using Motion Queries to Find Scenes in Sports Videos", Oct. 2013, ACM, Switzerland, pp. 1-3.
Jianping Fan et al., "Concept-Oriented Indexing of Video Databases: Towards Semantic Sensitive Retrieval and Browsing", IEEE, vol. 13, No. 7, Jul. 2004, pp. 1-19.
Shih-Fu Chang, et al., "VideoQ: A Fully Automated Video Retrieval System Using Motion Sketches", 1998, IEEE New York, pp. 1-2.
Wei-Te Li et al., "Exploring Visual and Motion Saliency for Automatic Video Object Extraction", IEEE, vol. 22, No. 7, Jul. 2013, pp. 1-11.
Odinaev, et al., "Cliques in Neural Ensembles as Perception Carriers", Technion—Israel Institute of Technology, 2006 International Joint Conference on Neural Networks, Canada, 2006, pp. 285-292.
The International Search Report and the Written Opinion for PCT/US2016/054634 dated Mar. 16, 2017, ISA/RU, Moscow, RU.
Yanagawa, et al., "Columbia University's Baseline Detectors for 374 LSCOM Semantic Visual Concepts." Columbia University ADVENT technical report, 2007, pp. 222-2006-8.
Johnson, John L, "Pulse-Coupled Neural Nets: Translation, Rotation, Scale, Distortion, and Intensity Signal Invariance for Images." Applied Optics, vol. 33, No. 26, 1994, pp. 6239-6253.
The International Search Report and the Written Opinion for PCT/US2016/050471, ISA/RU, Moscow, RU, dated May 4, 2017.
The International Search Report and the Written Opinion for PCT/US2017/015831, ISA/RU, Moscow, Russia, dated Apr. 20, 2017.
Burgsteiner et al., "Movement Prediction from Real-World Images Using a Liquid State machine", Innovations in Applied Artificial Intelligence Lecture Notes in Computer Science, Lecture Notes in Artificial Intelligence, LNCS, Springer-Verlag, BE, vol. 3533, Jun. 2005, pp. 121-130.
Hogue, "Tree Pattern Inference and Matching for Wrapper Induction on the World Wide Web", Master's Thesis, Massachusetts Institute of Technology, Jun. 2004, pp. 1-106.

(56) **References Cited**

OTHER PUBLICATIONS

Hua et al., "Robust Video Signature Based on Ordinal Measure", Image Processing, 2004, 2004 International Conference on Image Processing (ICIP), vol. 1, IEEE, pp. 685-688, 2004.
Johnson et al, "Pulse-Coupled Neural Nets: Translation, Rotation, Scale, Distortion, and Intensity Signal Invariance for Images", Applied Optics, vol. 33, No. 26, 1994, pp. 6239-6253.
McNamara et al., "Diversity Decay in opportunistic Content Sharing Systems", 2011 IEEE International Symposium on a World of Wireless, Mobile and Multimedia Networks, pp. 1-3.
Odinaev et al, "Cliques in Neural Ensembles as Perception Carriers", Technion—Institute of Technology, 2006 International Joint Conference on neural Networks, Canada, 2006, pp. 285-292.
Queluz, "Content-Based Integrity Protection of Digital Images", SPIE Conf. on Security and Watermarking of Multimedia Contents, San Jose, Jan. 1999, pp. 85-93.
Santos et al., "SCORM-MPEG: an Ontology of Interoperable Metadata for multimediaand E-Learning", 23rd International Conference on Software, Telecommunications and Computer Networks (SoftCom), 2015, pp. 224-228.
Schneider et al, "A Robust Content based Digital Signature for Image Authentication", Proc. ICIP 1996, Lausane, Switzerland, Oct. 1996, pp. 227-230.
Wilk et al., "The Potential of Social-Aware Multimedia Prefetching on Mobile Devices", International Conference and Workshops on networked Systems (NetSys), 2015, pp. 1-5.
Yanagawa et al., "Columbia University's Baseline Detectors for 374 LSCOM Semantic Visual Concepts", Columbia University Advent Technical Report #222, 2007, pp. 2006-2008.
Zou et al., "A Content-Based Image Authentication System with Lossless Data Hiding", ICME 2003, pp. 213-216.
Zhou et al, "Medical Diagnosis With C4.5 Rule Preceded by Artificial Neural Network Ensemble", IEEE Transactions on Information Technology in Biomedicine, vol. 7, Issue: 1, Mar. 2003, pp. 37-42.
Zhu et al., "Technology-Assisted Dietary Assesment", Proc SPIE. Mar. 20, 2008, pp. 1-15.
"Computer Vision Demonstration Website", Electronics and Computer Science, University of Southampton, 2005, USA.
Boari et al, "Adaptive Routing for Dynamic Applications in Massively Parallel Architectures", 1995 IEEE, Spring 1995, pp. 1-14.
Cernansky et al, "Feed-forward Echo State Networks", Proceedings of International Joint Conference on Neural Networks, Montreal, Canada, Jul. 31-Aug. 4, 2005, pp. 1-4.
Fathy et al, "A Parallel Design and Implementation for Backpropagation Neural Network Using MIMD Architecture", 8th Mediterranean Electrotechnical Conference, 19'96. MELECON '96, Date of Conference: May 13-16, 1996, vol. 3 pp. 1472-1475, vol. 3.
Freisleben et al, "Recognition of Fractal Images Using a Neural Network", Lecture Notes in Computer Science, 1993, vol. 6861, 1993, pp. 631-637.
Garcia, "Solving the Weighted Region Least Cost Path Problem Using Transputers", Naval Postgraduate School, Monterey, California, Dec. 1989.
Guo et al, AdOn: An Intelligent Overlay Video Advertising System (Year: 2009).
Howlett et al, "A Multi-Computer Neural Network Architecture in a Virtual Sensor System Application", International journal of knowledge-based intelligent engineering systems, 4 (2). pp. 86-93, 133N 1327-2314.
International Search Report and Written Opinion for PCT/US2016/050471, ISA/RU, Moscow, RU, dated May 4, 2017.
International Search Report and Written Opinion for PCT/US2016/054634, ISA/RU, Moscow, RU, dated Mar. 16, 2017.
International Search Report and Written Opinion for PCT/US2017/015831, ISA/RU, Moscow, RU, dated Apr. 20, 2017.
Lau et al., "Semantic Web Service Adaptation Model for a Pervasive Learning Scenario", 2008 IEEE Conference on Innovative Technologies in Intelligent Systems and Industrial Applications, 2008, pp. 98-103.
Li et al ("Matching Commercial Clips from TV Streams Using a Unique, Robust and Compact Signature" 2005) (Year: 2005).
Lin et al., "Generating robust digital signature for image/video authentication", Multimedia and Security Workshop at ACM Multimedia '98, Bristol, U.K., Sep. 1998, pp. 245-251.
Lyon, "Computational Models of Neural Auditory Processing", IEEE International Conference on Acoustics, Speech, and Signal Processing, ICASSP '84, Date of Conference: Mar. 1984, vol. 9, pp. 41-44.
May et al, "The Transputer", Springer-Verlag Berlin Heidelberg 1989, vol. 41.
Morad et al., "Performance, Power Efficiency and Scalability of Asymmetric Cluster Chip Multiprocessors", Computer Architecture Letters, vol. 4, Jul. 4, 2005, pp. 1-4, XP002466254.
Nagy et al, "A Transputer, Based, Flexible, Real-Time Control System for Robotic Manipulators", UKACC International Conference on CONTROL '96, Sep. 2-5, 1996, Conference Publication No. 427, IEE 1996.
Natschlager et al., "The "Liquid Computer": A novel strategy for real-time computing on time series", Special Issue on Foundations of Information Processing of telematik, vol. 8, No. 1, 2002, pp. 39-43, XP002466253.
Ortiz-Boyer et al, "CIXL2: A Crossover Operator for Evolutionary Algorithms Based on Population Features", Journal of Artificial Intelligence Research 24 (2005) Submitted Nov. 2004; published Jul. 2005, pp. 1-48.
Scheper et al, "Nonlinear dynamics in neural computation", ESANN'2006 proceedings—European Symposium on Artificial Neural Networks, Bruges (Belgium), Apr. 26-28, 2006, d-side publication, ISBN 2-930307-06-4, pp. 1-12.
Stolberg et al, "HIBRID-SOC: A Multi-Core SOC Architecture for Multimedia Signal Processing", 2003 IEEE, pp. 189-194.
Theodoropoulos et al, "Simulating Asynchronous Architectures on Transputer Networks", Proceedings of the Fourth Euromicro Workshop on Parallel and Distributed Processing, 1996. PDP '96, pp. 274-281.
Vallet et al ("Personalized Content Retrieval in Context Using Ontological Knowledge" Mar. 2007) (Year: 2007).
Verstraeten et al, "Isolated word recognition with the Liquid State Machine: a case study", Department of Electronics and Information Systems, Ghent University, Sint-Pietersnieuwstraat 41, 9000 Gent, Belgium, Available onlline Jul. 14, 2005, pp. 521-528.
Wang et al., "Classifying Objectionable Websites Based onImage Content", Stanford University, pp. 1-12.
Ware et al, "Locating and Identifying Components in a Robot's Workspace using a Hybrid Computer Architecture" Proceedings of the 1995 IEEE International Symposium on Intelligent Control, Aug. 27-29, 1995, pp. 139-144.
Whitby-Strevens, "The transputer", 1985 IEEE, pp. 292-300.
Yanagawa et al, "Columbia University's Baseline Detectors for 374 LSCOM Semantic Visual Concepts", Columbia University Advent Technical Report # 222-2006-8, Mar. 20, 2007, pp. 1-17.
Zhou et al, "Ensembling neural networks: Many could be better than all", National Laboratory for Novel Software Technology, Nanjing University, Hankou Road 22, Nanjing 210093, PR China Received Nov. 16, 2001, Available online Mar. 12, 2002, pp. 239-263.
Jasinschi et al., A Probabilistic Layered Framework for Integrating Multimedia Content and Context Information, 2002, IEEE, p. 2057-2060. (Year: 2002).
Jones et al., "Contextual Dynamics of Group-Based Sharing Decisions", 2011, University of Bath, p. 1777-1786. (Year: 2011).
Iwamoto, "Image Signature Robust to Caption Superimpostion for Video Sequence Identification", IEEE, pp. 3185-3188 (Year: 2006).
Cooperative Multi-Scale Convolutional Neural, Networks for Person Detection, Markus Eisenbach, Daniel Seichter, Tim Wengefeld, and Horst-Michael Gross Ilmenau University of Technology, Neuroinformatics and Cognitive Robotics Lab (Year; 2016).
Chen, Yixin, James Ze Wang, and Robert Krovetz. "CLUE: cluster-based retrieval of images by unsupervised learning." IEEE transactions on Image Processing 14.8 (2005); 1187-1201. (Year: 2005).
Wusk et al (Non-Invasive detection of Respiration and Heart Rate with a Vehicle Seat Sensor; www.mdpi.com/journal/sensors; Published: May 8, 2018). (Year: 2018).

(56) **References Cited**

OTHER PUBLICATIONS

Chen, Tiffany Yu-Han, et al. "Glimpse: Continuous, real-time object recognition on mobile devices." Proceedings of the 13th ACM Confrecene on Embedded Networked Sensor Systems. 2015. (Year: 2015).

* cited by examiner

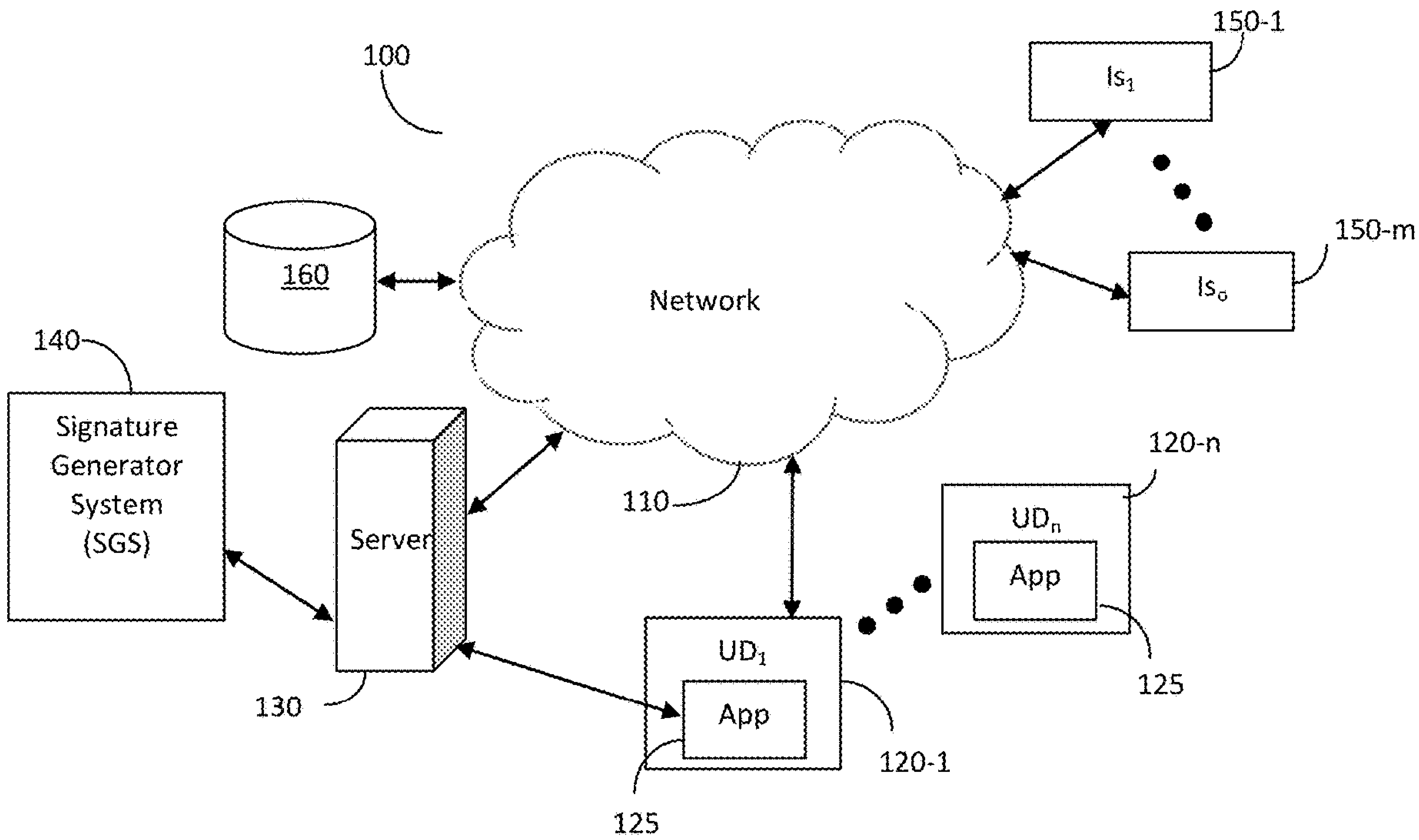

100
150-1
Is1
150-m
Iso
160
Network
140
Signature Generator System (SGS)
Server
110
120-n
UDn
App
125
UD1
App
130
120-1
125

FIG. 1

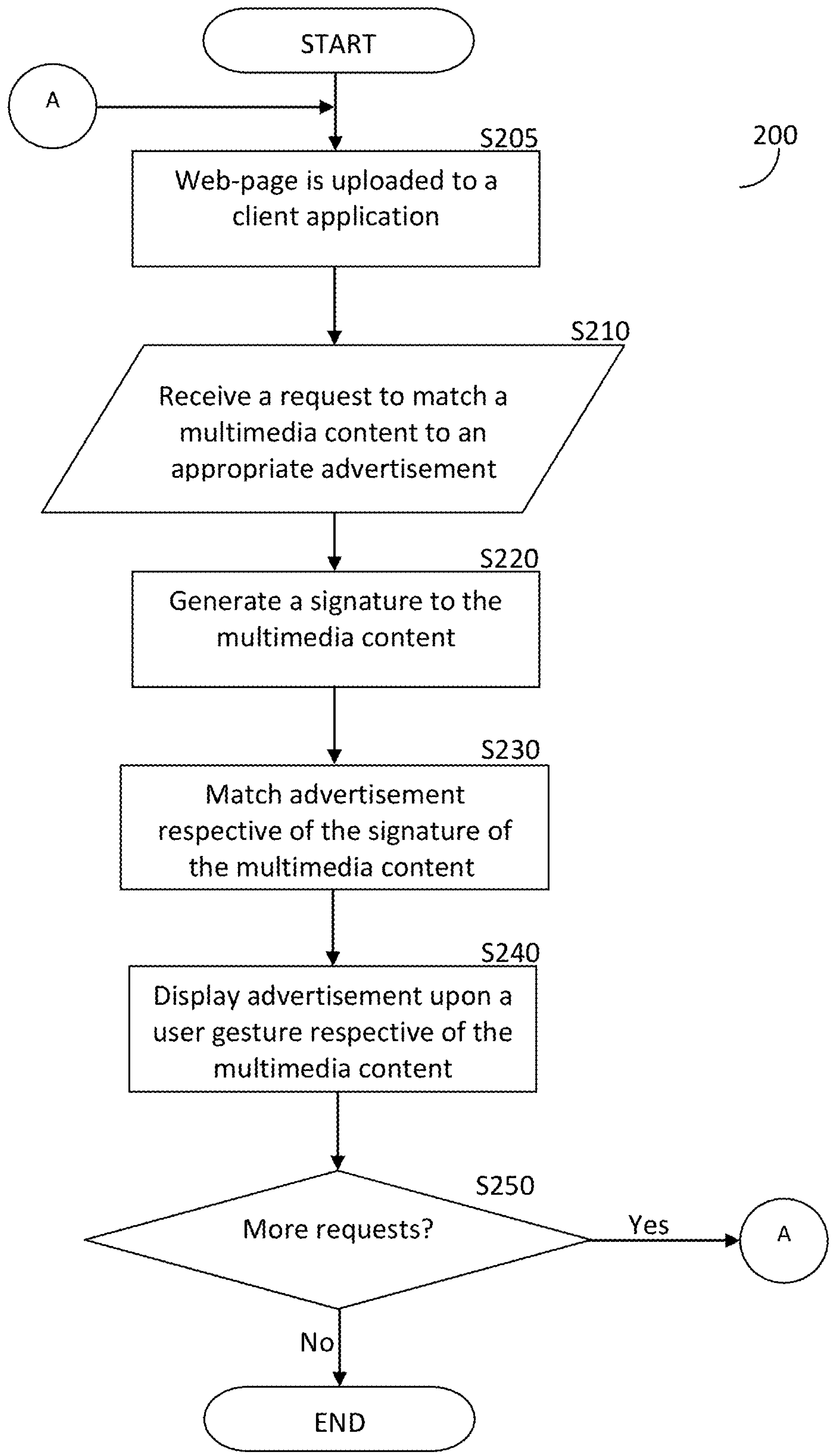

START
A
S205
200
Web-page is uploaded to a client application
S210
Receive a request to match a multimedia content to an appropriate advertisement
S220
Generate a signature to the multimedia content
S230
Match advertisement respective of the signature of the multimedia content
S240
Display advertisement upon a user gesture respective of the multimedia content
S250
More requests?
Yes
A
No
END

FIG. 2

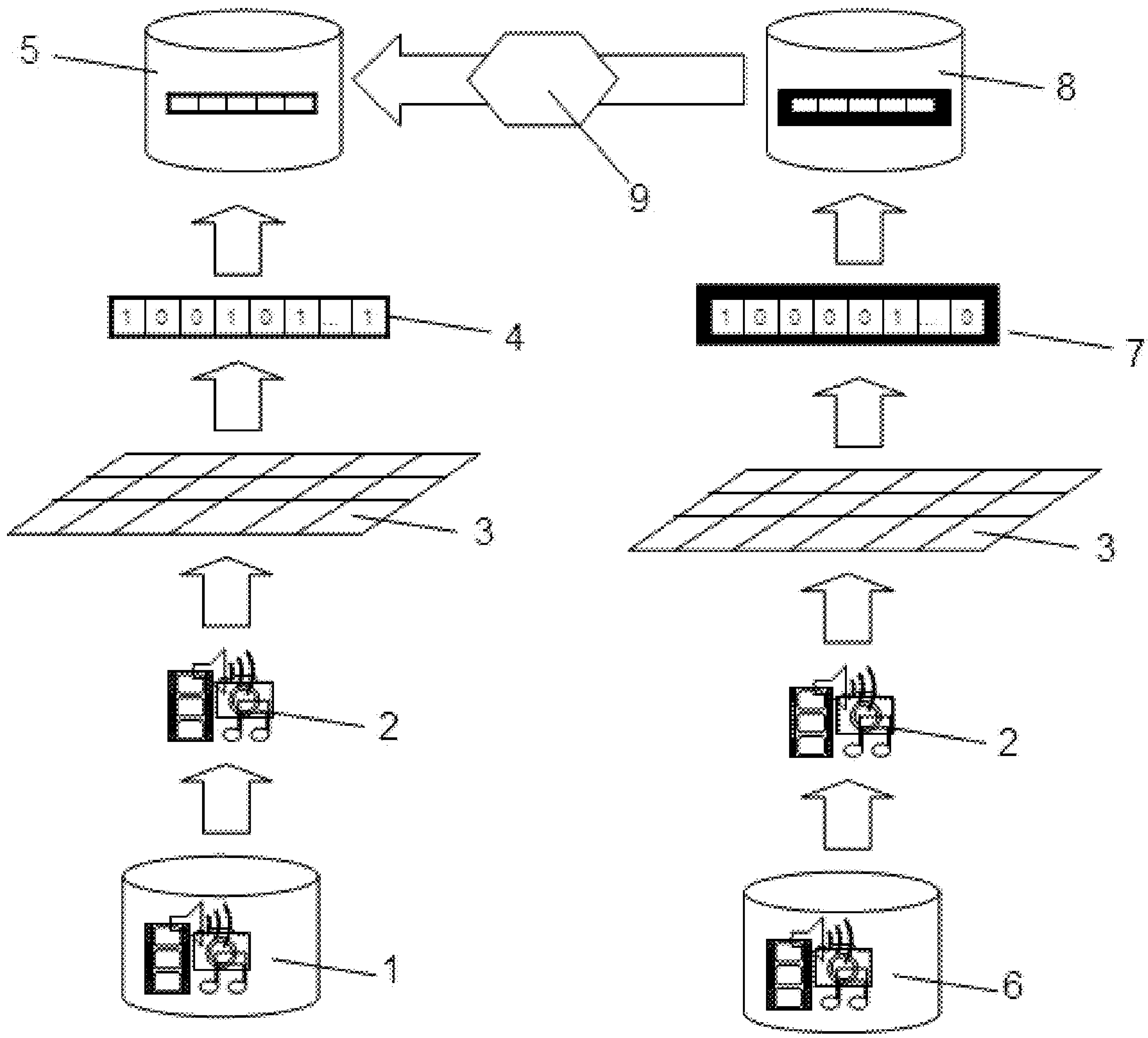


FIG. 3

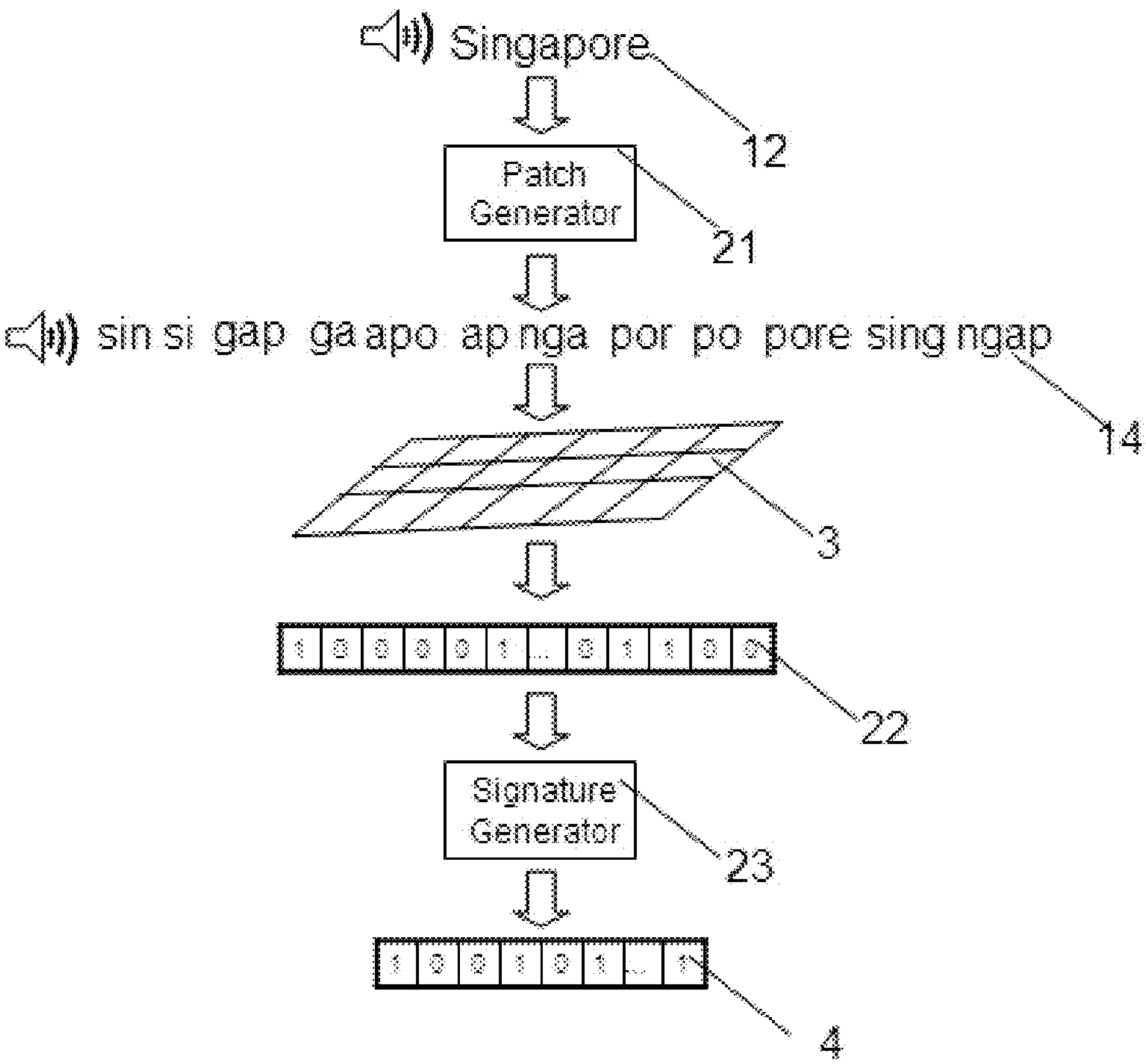

Singapore
12
Patch Generator
21
sin si gap ga apo ap nga por po pore sing ngap
14
3
22
Signature Generator
23
4

FIG. 4

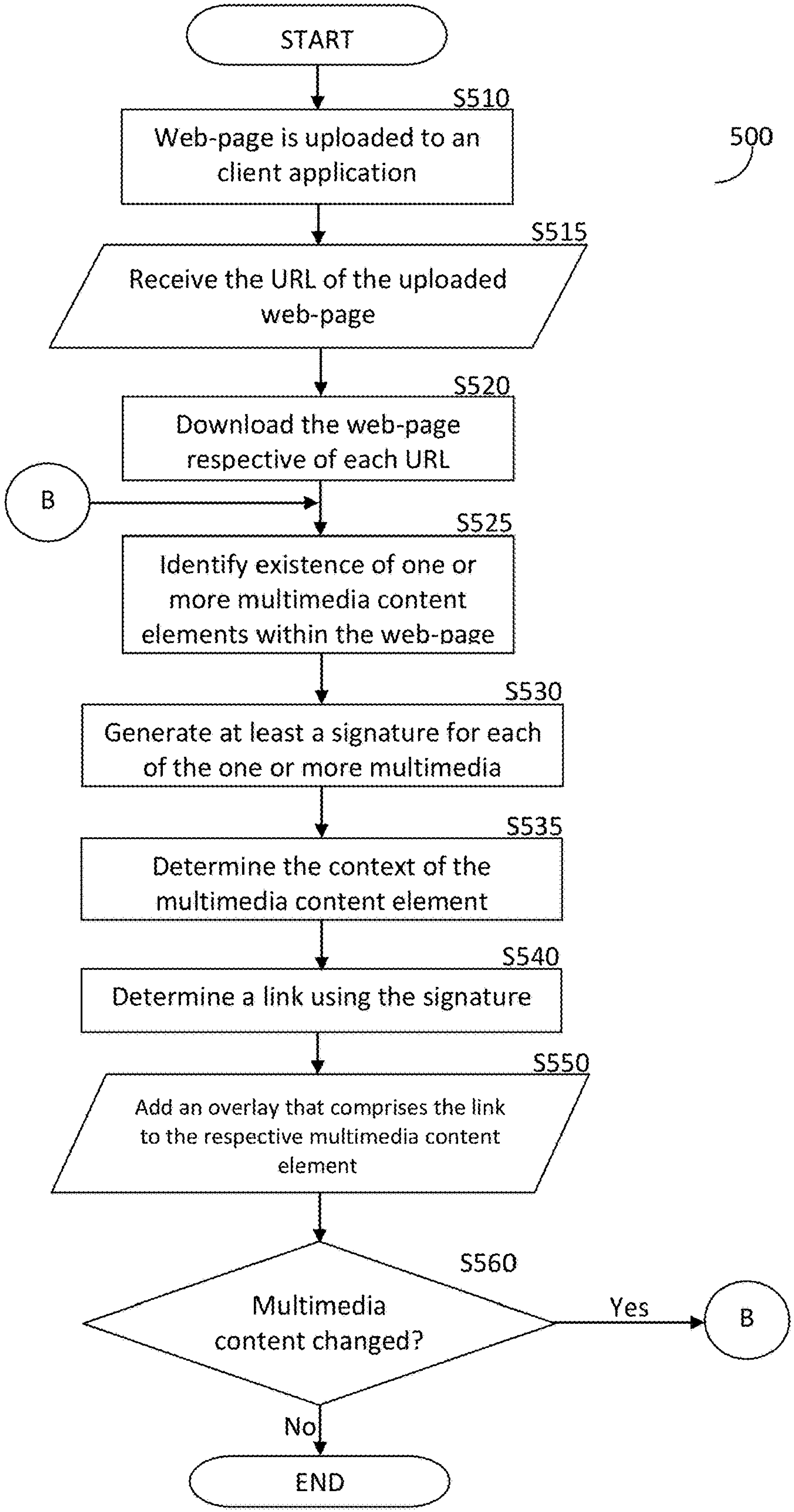
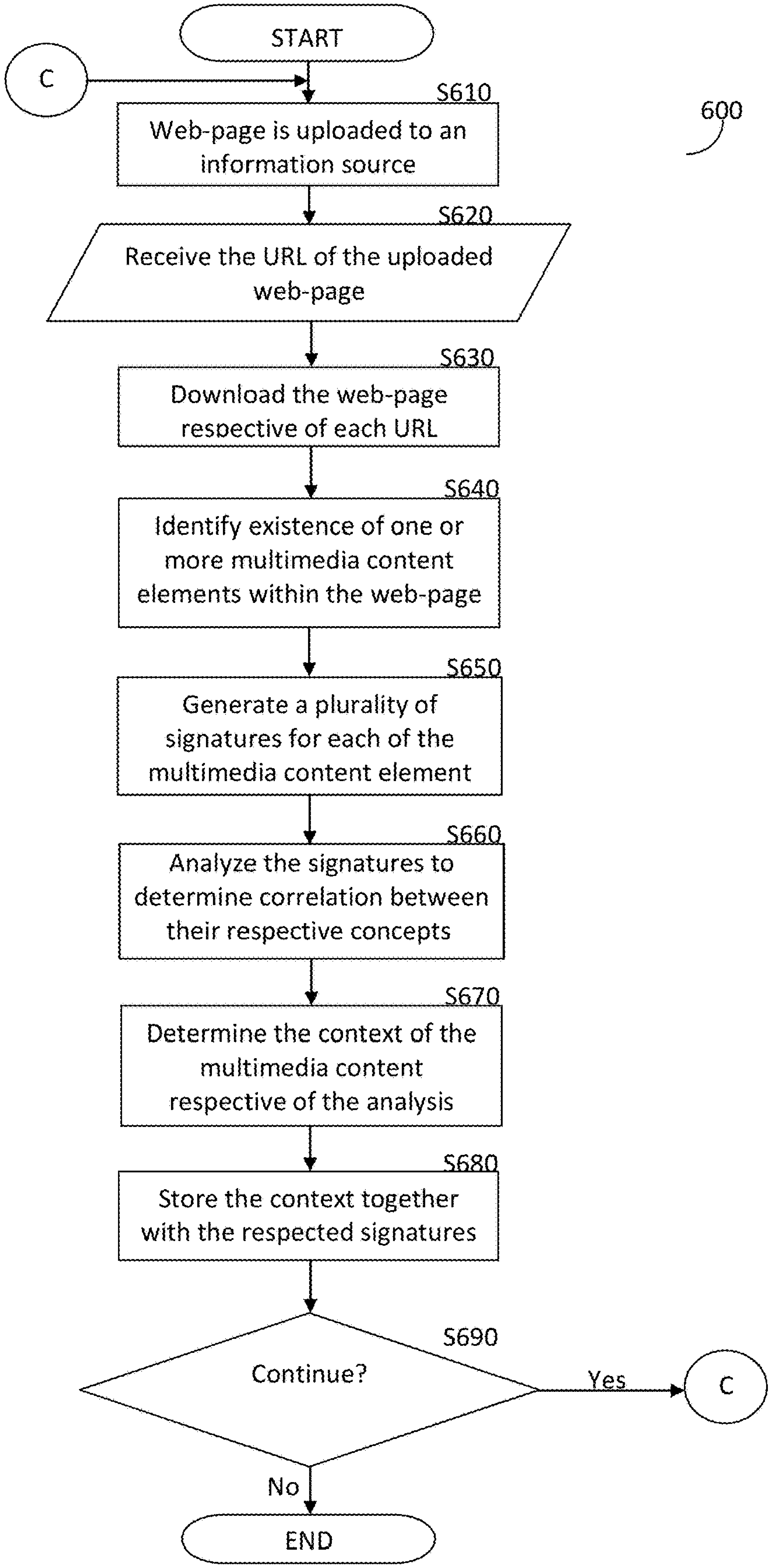

START
S510
Web-page is uploaded to an client application
500
S515
Receive the URL of the uploaded web-page
S520
Download the web-page respective of each URL
B
S525
Identify existence of one or more multimedia content elements within the web-page
S530
Generate at least a signature for each of the one or more multimedia
S535
Determine the context of the multimedia content element
S540
Determine a link using the signature
S550
Add an overlay that comprises the link to the respective multimedia content element
S560
Multimedia content changed?
Yes
B
No
END

FIG. 5



START
C
S610
Web-page is uploaded to an information source
600
S620
Receive the URL of the uploaded web-page
S630
Download the web-page respective of each URL
S640
Identify existence of one or more multimedia content elements within the web-page
S650
Generate a plurality of signatures for each of the multimedia content element
S660
Analyze the signatures to determine correlation between their respective concepts
S670
Determine the context of the multimedia content respective of the analysis
S680
Store the context together with the respected signatures
S690
Continue?
Yes
C
No
END

FIG. 6

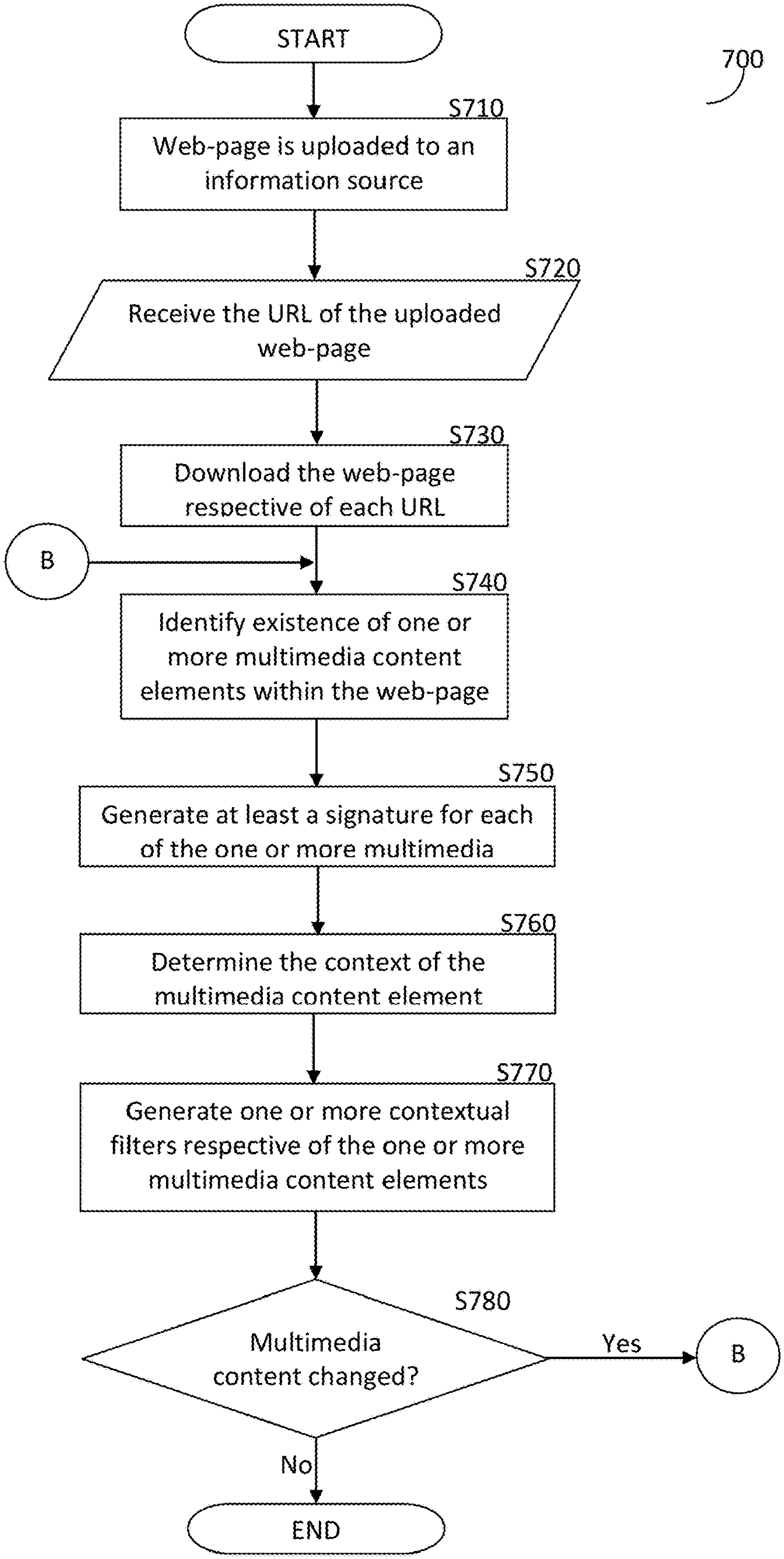

START
700
S710
Web-page is uploaded to an information source
S720
Receive the URL of the uploaded web-page
S730
Download the web-page respective of each URL
B
S740
Identify existence of one or more multimedia content elements within the web-page
S750
Generate at least a signature for each of the one or more multimedia
S760
Determine the context of the multimedia content element
S770
Generate one or more contextual filters respective of the one or more multimedia content elements
S780
Multimedia content changed?
Yes
B
No
END

FIG. 7

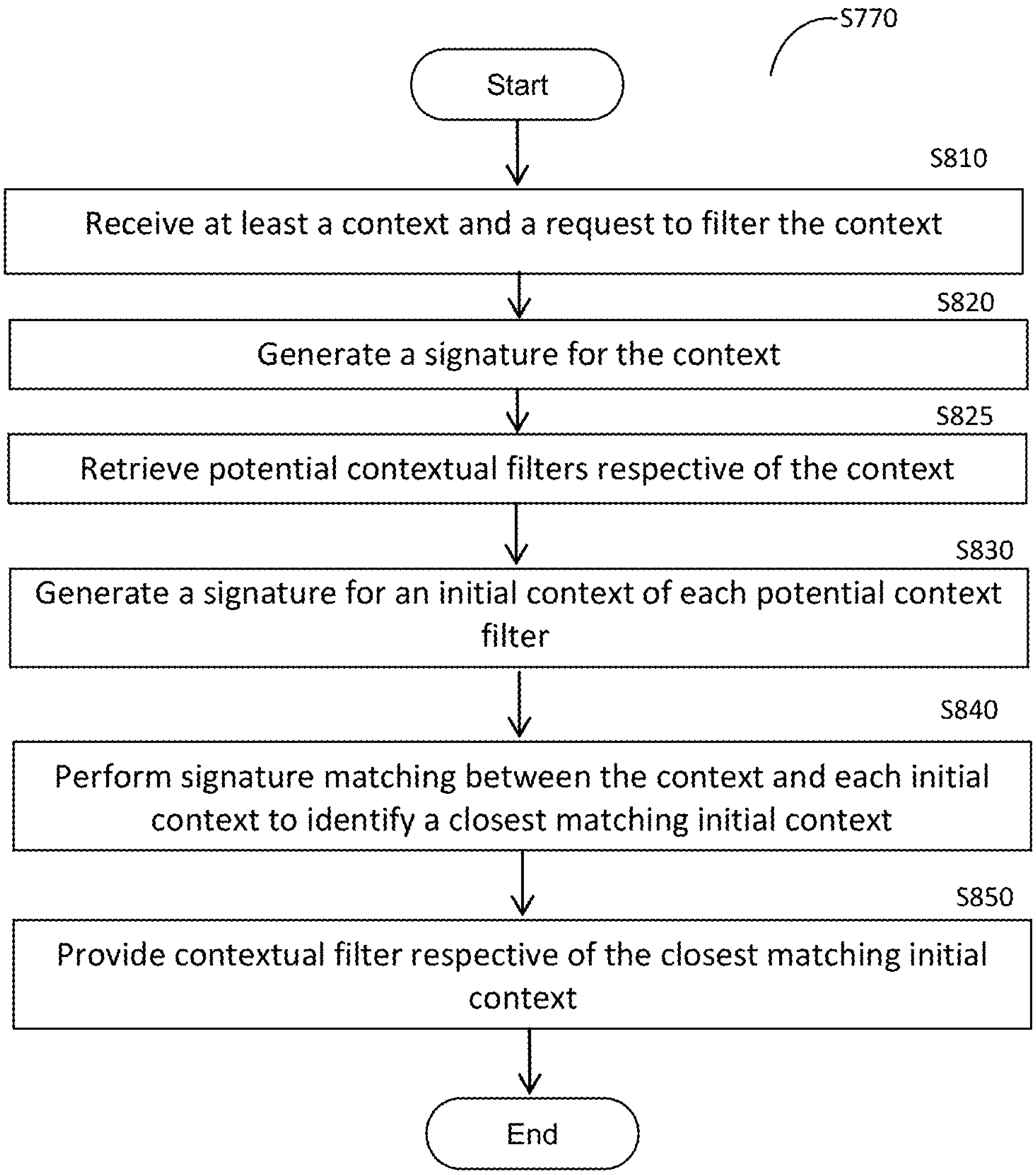

S770
Start
S810
Receive at least a context and a request to filter the context
S820
Generate a signature for the context
S825
Retrieve potential contextual filters respective of the context
S830
Generate a signature for an initial context of each potential context filter
S840
Perform signature matching between the context and each initial context to identify a closest matching initial context
S850
Provide contextual filter respective of the closest matching initial context
End

FIG. 8

SYSTEM AND METHOD FOR IDENTIFYING THE CONTEXT OF MULTIMEDIA CONTENT ELEMENTS DISPLAYED IN A WEB-PAGE AND PROVIDING CONTEXTUAL FILTERS RESPECTIVE THERETO

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of U.S. Provisional Application No. 61/773,349 filed on Mar. 6, 2013, the contents of which are herein incorporated by reference. This application is also a continuation-in-part (CIP) of U.S. patent application Ser. No. 13/624,397 filed on Sep. 21, 2012, now pending, which is a CIP of:

(a) U.S. patent application Ser. No. 13/344,400 filed on Jan. 5, 2012, now pending, which is a continuation of U.S. patent application Ser. No. 12/434,221, filed May 1, 2009, now U.S. Pat. No. 8,112,376;

(b) U.S. patent application Ser. No. 12/084,150 filed on Apr. 7, 2009, now U.S. Pat. No. 8,655,801, which is the National Stage of International Application No. PCT/IL2006/001235, filed on Oct. 26, 2006, which claims foreign priority from Israeli Application No. 171577 filed on Oct. 26, 2005 and Israeli Application No. 173409 filed on 29 Jan. 2006; and,

(c) U.S. patent application Ser. No. 12/195,863, filed Aug. 21, 2008, now U.S. Pat. No. 8,326,775, which claims priority under 35 USC 119 from Israeli Application No. 185414, filed on Aug. 21, 2007, and which is also a continuation-in-part (CIP) of the above-referenced U.S. patent application Ser. No. 12/084,150.

All of the applications referenced above are herein incorporated by reference for all that they contain.

TECHNICAL FIELD

The present invention relates generally to the analysis of multimedia content displayed in a web-page, and more specifically to a system for editing and filtering the context of multimedia content.

BACKGROUND

A web page is a document that is suitable for the World Wide Web and can be accessed through a web browser. Web pages generally contain other resources such as style sheets, scripts, and multimedia content elements in their final presentation. That is, media-rich web pages usually include information as to the colors of text, backgrounds, and links to multimedia content elements to be included in the final presentation when rendered by the web browser. A multimedia content element may include an image, graphics, a video stream, a video clip, an audio stream, an audio clip, and the like.

Web pages may consist of static or dynamic multimedia content elements retrieved from a web server's file system or by a web application. For example, a Facebook® page may include static images, such as a profile picture, and also dynamic contents of such pictures and/or video clips fed by other users.

In the related art there are different techniques for identifying the context of a web page. For example, the context may be determined based on the domain name of a web page mapped to a category (e.g., news, sports, etc.), textual analysis of the web page, or by information embedded in the

web page by a programmer of the page. Although such techniques may be efficient in determining the context of static web pages, they cannot provide the current context of the web page that is dynamically changed. Further, the granularity of such context analysis may be in most cases, high level (e.g., news) without providing the context of the current content or topic (e.g., election of a particular candidate) presented in the web page.

Furthermore, there is no available solution to determine the context of a web page based on multimedia content elements presented therein and specifically, dynamic elements. Extraction of individual multimedia content elements in the web page through the identification of a plurality of multimedia content elements to determine that their respective context is not discussed in the related art. As noted above, in a web page some of the multimedia content elements are static, such as background colors or images. However, such images can provide little information about the current context of the information presented in the web page. The dynamic elements often provide information that more accurately reflects the real story behind the current state of the web page.

It would therefore be advantageous to provide a solution that would overcome the deficiencies of the prior art by identifying a plurality of elements within multimedia content and determining the context of the multimedia content. It would be further advantageous if such a solution enable to editing and filtering of the context of the multimedia content.

SUMMARY

Certain embodiments disclosed herein include a method and system for providing contextual filters respective of an identified context of a plurality of multimedia content elements are provided. The method comprises receiving the plurality of multimedia content elements; generating at least one signature for each of the plurality of multimedia content elements; determining a context of each of the plurality of multimedia content elements based on its respective at least one signature, wherein a context is determined as the correlation among a plurality of cluster of signatures; and providing at least one contextual filter respective of the context of each of the plurality of multimedia content elements.

BRIEF DESCRIPTION OF THE DRAWINGS

The subject matter disclosed herein is particularly pointed out and distinctly claimed in the claims at the conclusion of the specification. The foregoing and other objects, features, and advantages of the invention will be apparent from the following detailed description taken in conjunction with the accompanying drawings.

FIG. **1** is a schematic block diagram of a network system utilized to describe the various embodiments disclosed herein;

FIG. **2** is a flowchart describing the process of matching an advertisement to a multimedia content element displayed on a web-page;

FIG. **3** is a block diagram depicting the basic flow of information in the signature generator system;

FIG. **4** is a diagram showing the flow of patches generation, response vector generation, and signature generation in a large-scale speech-to-text system;

FIG. **5** is a flowchart describing a process of adding an overlay to multimedia content displayed on a web-page;

FIG. 6 is a flowchart describing a method for determining the context indicated by the relation between multimedia content elements displayed in a web-page according to one embodiment;

FIG. 7 is a flowchart describing a method for providing one or more contextual filters according to one embodiment; and

FIG. 8 is a flowchart demonstrating a method for generating contextual filters according to an embodiment.

DETAILED DESCRIPTION

It is important to note that the embodiments disclosed herein are only examples of the many advantageous uses of the innovative teachings herein. In general, statements made in the specification of the present application do not necessarily limit any of the various claimed inventions. Moreover, some statements may apply to some inventive features but not to others. In general, unless otherwise indicated, singular elements may be in plural and vice versa with no loss of generality. In the drawings, like numerals refer to like parts through several views.

Certain exemplary embodiments disclosed herein provide a system and method that determine the context of one or more multimedia content elements, or portions thereof and provide one or more contextual filters respective thereto. Accordingly, at least one signature is generated for each multimedia content element, or portion thereof displayed. Then, the signatures are analyzed to determine the concept of each of the signatures and the context of the one or more multimedia content elements respective thereto. In one embodiment, the one or more multimedia content elements are extracted from a web-page. One or more contextual filters are then provided to the user respective of the concept of each of the signatures and the context of the one or more multimedia content elements respective thereto. The contextual filters enable a user to edit one or more elements within the multimedia content.

FIG. **1** shows an exemplary and non-limiting schematic diagram of a network system **100** utilized to describe the various embodiments disclosed herein. A network **110** is used to communicate between different parts of the system **100**. The network **110** may be the Internet, the world-wide-web (WWW), a local area network (LAN), a wide area network (WAN), a metro area network (MAN), and other networks capable of enabling communication between the elements of the system **100**.

Further connected to the network **110** are one or more user devices **120-1** through **120-*n*** (collectively referred to hereinafter as user devices **120** or individually as a user device **120**) through one or more client applications **125**. A user device **120** may be, for example, a personal computer (PC), a personal digital assistant (PDA), a mobile phone, a smart phone, a tablet computer, a wearable computing device, and other kinds of wired and mobile appliances, equipped with browsing, viewing, listening, filtering, and managing capabilities, etc., that are enabled as further discussed herein below.

The system **100** also includes a plurality of information sources **150-1** through **150-*m*** (collectively referred to hereinafter as information sources **150** or individually as information sources **150**) being connected to the network **110**. Each of the information sources **150** may be, for example, a web server, an application server, a publisher server, an ad-serving system, a data repository, a database, and the like. Also connected to the network **110** is a data warehouse **160** that stores multimedia content elements, clusters of multimedia content elements, and the context determined for a web page as identified by its URL. In the embodiment illustrated in FIG. **1**, a context server **130** communicates with the data warehouse **160** through the network **110**. In other non-limiting configurations, the context sever **130** is directly connected to the data warehouse **160**.

The various embodiments disclosed herein are realized using the context server **130** and a signature generator system (SGS) **140**. The SGS **140** may be connected to the context server **130** directly or through the network **110**. The context server **130** is enabled to receive and serve multimedia content elements and causes the SGS **140** to generate a signature respective of the multimedia content elements. The process for generating the signatures for multimedia content is explained in more details herein below with respect to FIGS. **3** and **4**. It should be noted that each of the context server **130** and the SGS **140** typically comprises a processing unit, such as a processor (not shown) that is coupled to a memory. The memory contains instructions that can be executed by the processing unit. The transaction of the context server **130** also includes an interface (not shown) to the network **110**.

According to the disclosed embodiments, the context server **130** is configured to receive at least a URL of a web page hosted in an information source **150** and accessed by a user device **120**. The context server **130** is further configured to analyze the multimedia content elements contained in the web page to determine their context, thereby ascertaining the context of the web page. This is performed based on at least one signature generated for each multimedia content element. It should be noted that the context of an individual multimedia content element or a group of elements is extracted from the web page, received from a user device **120** (e.g., uploaded video clip), or retrieved from the data warehouse **160**.

A user visits a web-page using a user device **120**. When the web-page is uploaded on the user device **120**, a request is sent to the context server **130** to analyze the multimedia content elements contained in the web-page. The request to analyze the multimedia content elements can be generated and sent by a script executed in the web-page, an agent installed in the web-browser, or by one of the information sources **150** (e.g., a web server or a publisher server) when requested to upload one or more advertisements to the web-page. The request to analyze the multimedia content may include a URL of the web-page or a copy of the web-page. In one embodiment, the request may include multimedia content elements extracted from the web-page. A multimedia content element may include, for example, an image, a graphic, a video stream, a video clip, an audio stream, an audio clip, a video frame, a photograph, and an image of signals (e.g., spectrograms, phasograms, scalograms, etc.), and/or combinations thereof and portions thereof.

The context server **130** is configured to analyze the multimedia content elements in the web-page to determine their context. For example, if the web page contains images of palm trees, a beach, and the coast line of San Diego, the context of the web page may be determined to be "California sea shore." The determined context can be utilized to detect one or more matching advertisements for the multimedia content elements. According to this embodiment, the SGS **140** generates for each multimedia content element provided by the context server **130** at least one signature. The generated signature(s) may be robust to noise and distortion as discussed below. Then, using the generated signature(s), the context server **130** determines the context of the elements and searches the data warehouse **160** for a matching advertisement based on the context. For example, if the signature of an image indicates a "California sea shore", then an advertisement for a swimsuit can be a potential matching advertisement.

It should be noted that using signatures for determining the context and thereby for the searching of advertisements ensures more accurate reorganization of multimedia content than, for example, when using metadata instead. For instance, in order to provide a matching advertisement for a sports car it may be desirable to locate a car of a particular model. However, in most cases the model of the car would not be part of the metadata associated with the multimedia content (image). Moreover, the car shown in an image may be at angles different from the angles of a specific photograph of the car that is available as a search item.

It should be appreciated that the signature generated for that image would enable accurate recognition of the model of the car because the signatures generated for the multimedia content elements, according to the disclosed embodiments, allow for recognition and classification of multimedia content elements, such as content-tracking, video filtering, multimedia taxonomy generation, video fingerprinting, speech-to-text, audio classification, element recognition, video/image search and any other application requiring content-based signatures generation and matching for large content volumes such as, web and other large-scale databases.

In one embodiment, the signatures generated for more than one multimedia content element are clustered. The clustered signatures are used to determine the context of the web page and to search for a matching advertisement. It should be noted that other content items that are not advertisements may be determined. The one or more selected matching advertisements are retrieved from the data warehouse **160** and uploaded to the web-page on the web browser **120**.

FIG. **2** depicts an exemplary and non-limiting flowchart **200** describing the process of matching an advertisement to multimedia content displayed on a web-page. In S**205**, a web-page is uploaded to one of the client applications (e.g., client application **125**). In S**210**, a request to match at least one multimedia content element contained in the uploaded web-page to an appropriate advertisement item is received. The request can be received from a publisher server, a script running on the uploaded web-page, or the client application **125**. S**210** can also include extracting the multimedia content elements for a signature that should be generated.

In S**220**, at least one signature for the multimedia content element executed from the web page is generated. The signature for the multimedia content element generated by a signature generator is described below with respect to FIGS. **3** and **4**. In one embodiment, based on the generated signatures, the context of the extracted multimedia content elements, and thereby the web page, is determined as described below with respect to FIG. **6**.

In S**230**, an advertisement item is matched to the multimedia content element respective of its generated signatures and/or the determined context. The matching process includes searching for at least one advertisement item respective of the signature of the multimedia content and a display of the at least one advertisement item within the display area of the web-page. The signatures generated for the multimedia content elements are clustered and the cluster of signatures is matched to one or more advertisement items. The matching of an advertisement to a multimedia content element can be performed by the computational cores that are part of a large scale matching discussed in detail below.

In S**240**, upon a user's gesture the advertisement item is uploaded to the web-page and displayed therein. The user's gesture may be: a scroll on the multimedia content element, a press on the multimedia content element, and/or a response to the multimedia content. This ensures that the user's attention is given to the advertised content. In S**250**, it is checked whether there are additional requests to analyze multimedia content elements, and if so, execution continues with S**210**; otherwise, execution terminates.

As a non-limiting example, an image that contains a plurality of multimedia content elements is identified by the context server **130** in an uploaded web-page. The SGS **140** generates at least one signature for each multimedia content element executed from the image that exists in the web page. According to this example a printer and a scanner are shown in the image and the SGS **140** generates signatures respective thereto. The server **130** is configured to determine that the context of the image is office equipment. Therefore, the context server **130** is configured to match at least one advertisement suitable for office equipment.

FIGS. **3** and **4** illustrate the generation of signatures for the multimedia content elements by the SGS **140** according to one embodiment. An exemplary high-level description of the process for large scale matching is depicted in FIG. **3**. In this example, the matching is for a video content.

Video content segments **2** from a Master database (DB) **6** and a Target DB **1** are processed in parallel by a large number of independent computational Cores **3** that constitute an architecture for generating the Signatures (hereinafter the "Architecture"). Further details on the computational Cores generation are provided below. The independent Cores **3** generate a database of Robust Signatures and Signatures **4** for Target content-segments **5** and a database of Robust Signatures and Signatures **7** for Master content-segments **8**. An exemplary and non-limiting process of signature generation for an audio component is shown in detail in FIG. **4**. Finally, Target Robust Signatures and/or Signatures are effectively matched, by a matching algorithm **9**, to Master Robust Signatures and/or Signatures database to find all matches between the two databases.

To demonstrate an example of the signature generation process, it is assumed, merely for the sake of simplicity and without limitation on the generality of the disclosed embodiments, that the signatures are based on a single frame, leading to certain simplification of the computational cores generation. The Matching System is extensible for signatures generation capturing the dynamics in-between the frames.

The Signatures' generation process is now described with reference to FIG. **4**. The first step in the process of signatures generation from a given speech-segment is to breakdown the speech-segment to K patches **14** of random length P and random position within the speech segment **12**. The breakdown is performed by the patch generator component **21**. The value of the number of patches K, random length P and random position parameters is determined based on optimization, considering the tradeoff between accuracy rate and the number of fast matches required in the flow process of the context server **130** and SGS **140**. Thereafter, all the K patches are injected in parallel into all computational Cores **3** to generate K response vectors **22**, which are fed into a signature generator system **23** to produce a database of Robust Signatures and Signatures **4**.

In order to generate Robust Signatures, i.e., Signatures that are robust to additive noise L (where L is an integer equal to or greater than 1) by the Computational Cores **3** a frame T is injected into all the Cores **3**. Then, Cores **3** generate two binary response vectors: $\vec{S}$ which is a Signature vector, and $\overrightarrow{RS}$ which is a Robust Signature vector.

For generation of signatures robust to additive noise, such as White-Gaussian-Noise, scratch, etc., but not robust to distortions, such as crop, shift and rotation, etc., a core Ci={ni} (1≤i≤L) may consist of a single leaky integrate-to-threshold unit (LTU) node or more nodes. The node n_i equations are:

$$V_i = \sum_j w_{ij} k_j$$

$$n_i = \square(Vi - Th_x)$$

where, □ is a Heaviside step function; w_{ij} is a coupling node unit (CNU) between node i and image component j (for example, grayscale value of a certain pixel j); kj is an image component 'j' (for example, grayscale value of a certain pixel j); Th_x is a constant Threshold value, where 'x' is 'S' for Signature and 'RS' for Robust Signature; and Vi is a Coupling Node Value.

The Threshold values Th_x are set differently for Signature generation and for Robust Signature generation. For example, for a certain distribution of Vi values (for the set of nodes), the thresholds for Signature (Th_S) and Robust Signature (Th_{RS}) are set apart, after optimization, according to at least one or more of the following criteria:

1: For: $V_i > Th_{RS}$

$1-p(V>Th_S)-1-(1-\varepsilon)^1 \ll 1$

i.e., given that/nodes (cores) constitute a Robust Signature of a certain image I, the probability that not all of these I nodes will belong to the Signature of same, but noisy image, $\tilde{\ }$ is sufficiently low (according to a system's specified accuracy).

2: $p(V_i > Th_{RS}) \approx 1/L$

i.e., approximately l out of the total L nodes can be found to generate a Robust Signature according to the above definition.

3: Both Robust Signature and Signature are generated for certain frame i.

It should be understood that the generation of a signature is unidirectional, and typically yields lossless compression, where the characteristics of the compressed data are maintained but the uncompressed data cannot be reconstructed. Therefore, a signature can be used for the purpose of comparison to another signature without the need of comparison to the original data. The detailed description of the Signature generation can be found in U.S. Pat. Nos. 8,326,775 and 8,312,031, assigned to common assignee, which are hereby incorporated by reference for all the useful information they contain.

A Computational Core generation is a process of definition, selection, and tuning of the parameters of the cores for a certain realization in a specific system and application. The process is based on several design considerations, such as:

(a) The Cores should be designed so as to obtain maximal independence, i.e., the projection from a signal space should generate a maximal pair-wise distance between any two cores' projections into a high-dimensional space.

(b) The Cores should be optimally designed for the type of signals, i.e., the Cores should be maximally sensitive to the spatio-temporal structure of the injected signal, for example, and in particular, sensitive to local correlations in time and space. Thus, in some cases a core represents a dynamic system, such as in state space, phase space, edge of chaos, etc., which is uniquely used herein to exploit their maximal computational power.

(c) The Cores should be optimally designed with regard to invariance to a set of signal distortions, of interest in relevant applications.

A detailed description of the Computational Core generation and the process for configuring such cores is discussed in more detail in U.S. Pat. No. 8,655,801 referenced above.

FIG. **5** depicts an exemplary and non-limiting flowchart **500** describing the process of adding an overlay to multimedia content displayed on a web-page according to one embodiment. In S**510**, the process starts when a web-page is uploaded to a client application (e.g., client application **125**) or when an information source (e.g., information source **150-1**) receives a request to host the requested web-page. In S**515**, the context server **130** receives the uniform resource locator (URL) of the uploaded web-page. In another embodiment, the uploaded web-page includes an embedded script. The script extracts the URL of the web-page, and sends the URL to the context server **130**. In another embodiment, an add-on installed in the web-browser executed by a user device **120** extracts the URL of the uploaded web-page, and sends the URL to the context server **130**. In yet another embodiment, an agent is installed on a user device executing the web browser executed by a user device **120**. The agent is configured to monitor web-pages uploaded to the website, extract the URLs, and send them to the server context **130**. In another embodiment, a web-server (e.g., information source **150**) hosting the requested web-page provides the context server **130** with the URL of the requested web-page. It should be noted that only URLs of selected web sites can be sent to the context server **130**, for example, URLs related to web-sites that paid for the additional information.

In S**520**, the web-page respective of each received URL is downloaded to the context server **130**. In S**525**, the web-page is then analyzed in order to identify the existence of at least one or more multimedia content elements in the uploaded web-page. It should be understood that a multimedia content element, such as an image or a video, may include a plurality of multimedia content elements. In S**530**, for each multimedia content element identified by the context server **130**, at least one signature is generated. The signatures for the multimedia content elements are generated as described in greater detail above.

In S**535**, respective of each signature, the context of the multimedia content element is determined. The determination of context based on the signatures is discussed in more detail below. In S**540**, respective of the context or the signature of the elements, the context server **130** determines one or more links to content that exist on an information source, for example, an information source **150** that can be associated with the multimedia content element. A link may be a hyperlink, a URL, and the like to external resource information.

That is, the content accessed through the link may be, for example, informative web-pages such as a page from the Wikipedia® website. The determination of the link may be made by identification of the context of the signatures generated by the context server **130**. As an example, if the context of the multimedia content elements was identified as a football player, then a link to a sports website that contains information about the football player is determined.

In S550, the determined link to the content is added as an overlay to the web-page by the context server 130, respective of the corresponding multimedia content element. According to one embodiment, a link that contains the overlay may be provided to a web browser (e.g., a web browser executed by user device 120-1) respective of a user's gesture. A user's gesture may be: a scroll on the multimedia content element, a click on the at least one multimedia content element, and/or a response to the at least one multimedia content or portion thereof.

The modified web-page that includes at least one multimedia content element with the added link can be sent directly to the web browser requesting the web-page. This requires establishing a data session between the context server 130 and the web browsers. In another embodiment, the multimedia element including the added link is returned to a web server (e.g., information source 150) hosting the requested web-page. The web server returns the requested web-page with the multimedia element containing the added link to the web browser requesting the web-page. Once the "modified" web-page is displayed over the web browser on user device 120-1, a detected user's gesture over the multimedia element would cause the web browser to upload the content (e.g., a Wikipedia web-page) accessed by the link added to the multimedia element.

In S560, it is checked whether the one or more multimedia content elements contained in the web-page has changed, and if so, execution continues with S525; otherwise, execution terminates.

As a non-limiting example, a web-page containing an image of the movie "Pretty Woman" is uploaded to the context server 130. A signature is generated by the SGS 140 respective of the actor Richard Gere and the actress Julia Roberts, both shown in the image. The context of the signatures according to this example may be "American Movie Actors". An overlay containing the links to Richard Gere's biography and Julia Roberts' biography on the Wikipedia® website is added over the image such that upon detection of a user's gesture, for example, a mouse clicking over the part of the image where Richard Gere is shown, the link to Richard Gere's biography on Wikipedia® is provided to the user.

As a non-limiting example, a web-page that contains an embedded video clip is requested by a web browser executed by a user device 120-1 from an information source 150-1 and a banner advertising New York City. The context server 130 receives the requested URL. The context server 130 analyzes the video content and the banner within the requested web-page and a signature is generated by the SGS 140 respective of the entertainer Madonna that is shown in the video content and the banner. The context of multimedia content embedded in the web page is determined to be "live pop shows in NYC." In response to the determined context, a link to a hosted web site for purchasing show tickets is added as an overlay to the video clip. The web-page together with the added link is sent to a web server (e.g., an information source 150-1), which then uploads the requested web-page with the modified video element to the web-browser.

The web-page may contain a number of multimedia content elements; however, in some instances only a few links may be displayed in the web-page. Accordingly, in one embodiment, the signatures generated for the multimedia content elements are clustered and the cluster of signatures is matched to one or more advertisement items.

FIG. 6 shows an exemplary and non-limiting example for determining a context of a multimedia content according to one embodiment. The method may be performed by the context server 130. In S610, a web-page is uploaded to a web-browser (e.g., a web-browser executed by user device 120-1). In another embodiment, the method starts when a web server (e.g., information source 150-1) receives a request to host the requested web-page.

In S620, the uniform resource locator (URL) of the web-page to be processed is received. In another embodiment, the uploaded web-page includes an embedded script. The script extracts the URL of the web-page, and sends the URL to the context server 130. In another embodiment, an add-on installed in the web-browser executed by a user device 120-1 extracts the URL of the uploaded web-page, and sends the URL to the context server 130. In yet another embodiment, client application 125 is configured to monitor web-pages uploaded to the web-site, extract the URLs, and send them to the context server 130. In another embodiment, the web-server (e.g., an information source 150-1) hosting the requested web-page, provides the context server 130 with the URL of the requested web-page. It should be noted that only URLs of selected web sites can be sent to the context server 130, for example, URLs related to web-sites that paid for the additional information.

In S630, the web-page respective of each received URL is downloaded to the context server 130. In S640, the web-page is then analyzed in order to identify the existence of one or more multimedia content elements in the uploaded web-page. Each identified multimedia content element is extracted from the web-page and sent to the SGS 140.

In S650, at least one signature generated for each identified multimedia content element is received by the context server 130. The at least one signature is generated by the SGS and is robust for noise and distortion. The signatures for the multimedia content elements are generated as described in greater detail above. It should also be noted that signatures can be generated for portions of a multimedia content element.

In S660, the correlation between the signatures of all extracted multimedia content elements, or portions thereof is analyzed. Specifically, each signature represents a different concept. The signatures are analyzed to determine the correlation concepts. A concept is an abstract description of the content to which the signature was generated. For example, a concept of the signature generated for a picture showing a bouquet of red roses is "flowers." The correlation between concepts can be achieved by identifying a ratio between signatures' sizes, a spatial location of each signature, and so on using probabilistic models. As noted above a signature represents a concept and is generated for a multimedia content element. Thus, identifying, for example, the ratio of signatures' sizes may also indicate the ratio between the sizes of their respective objects and entities captured in their respective multimedia elements.

A context is determined as the correlation among a plurality of concepts. A strong context is determined when there are more concepts, or the plurality of concepts, that satisfy the same predefined condition. An example for such context determination using signatures is disclosed in a co-pending U.S. patent application Ser. No. 13/766,463, filed Feb. 13, 2013, entitled "A SYSTEM AND METHODS FOR GENERATION OF A CONCEPT BASED DATABASE", assigned to common assignee, which is hereby incorporated by reference for all the useful information it contains. As an example, the server 130 analyzes signatures generated for multimedia content elements of a smiling child with a Ferris wheel in the background. The concept of the signature of the smiling child is "amusement" and the concept of a signature of the Ferris wheel is "amusement park." The server **130** further analyzes the relation between the signatures of the child and recognized wheel, to determine that the Ferris wheel is bigger than the child. The relation analysis determines that the Ferris wheel is used to entertain the child. Therefore, the determined context may be "amusement."

According to one embodiment, the context server **130** uses one or more typically probabilistic models to determine the correlation between signatures representing concepts. The probabilistic models determine, for example, the probability that a signature may appear in the same orientation and in the same ratio as another signature. When performing the analysis, the context server **130** utilizes information maintained in the data warehouse **160**, for example, signatures previously analyzed. In S**670**, the context server **130** determines, based on the analysis performed in S**660**, the context of a plurality of multimedia content elements that exist in the web-page and in the context of the web-page.

As an example, an image that contains a plurality of multimedia content elements is identified by the context server **130** in an uploaded web-page. The SGS **140** generates at least one signature for each of the plurality of multimedia content elements that exist in the image. According to this example, the multimedia contents of the singer "Adele," the "red carpet," and a "Grammy" award are shown in the image. The SGS **140** generates signatures respective thereto. The context server **130** analyzes the correlation between "Adele," the "red carpet," and a "Grammy" award and determines the context of the image based on the correlation. According to this example such a context may be "Adele Winning the Grammy Award".

The following is another non-limiting example demonstrating the operation of the server **130**. In this example, a web page containing a plurality of multimedia content elements is identified by the context server **130** in an uploaded web-page. According to this example, the SGS **140** generates signatures for the objects such as a "glass," a piece of "cutlery," and a "plate" which appear in the multimedia elements. The context server **130** then analyzes the correlation between the concepts generated by signatures respective of the data maintained in the data warehouse **160**, for example, analysis of previously generated signatures. According to this example, as all of the concepts "glass," "cutlery," and "plate" satisfy the same predefined condition, a strong context is determined. The context of such concepts may be a "table set". The context can be also determined respective of a ratio of the sizes of the objects (glass, cutlery, and plate) in the image and the distinction of their spatial orientation.

In S**680**, the context of the multimedia content together with the respective signatures is stored in the data warehouse **160** for future use. In S**690**, it is checked whether there are additional web-pages and if so execution continues with S**610**; otherwise, execution terminates.

FIG. **7** depicts an exemplary and non-limiting flowchart **700** describing the process of providing contextual filters according to one embodiment. The method may be performed by the context server **130**. In S**710**, the method starts when a web-page is uploaded to a web-browser (e.g., web-browser executed by user device **120-1**) or when a web-server (e.g., information source **150-1**) receives a request to host the requested web-page. In S**720**, the uniform resource locator (URL) of the uploaded web-page is received at the context server **130**.

In another embodiment, the uploaded web-page includes an embedded script. The script extracts the URL of the web-page, and sends the URL to the context server **130**. In another embodiment, an add-on installed in the web-browser extracts the URL of the uploaded web-page, and sends the URL to the context server **130**. In yet another embodiment, an agent is installed on a user device executing the web browser. The agent is configured to monitor web-pages uploaded to the web-site, extract the URLs, and send them to the server context **130**. In another embodiment, a web-server (e.g., information source **150-1**) hosting the requested web-page, provides the context server **130** with the URL of the requested web-page. It should be noted that only URLs of selected web sites can be sent to the context server **130**, for example, URLs related to web-sites that paid for the additional information.

In S**730**, the web-page respective of each received URL is downloaded to the context server. In S**740**, the web-page is then analyzed in order to identify the existence of at least one or more multimedia content elements in the uploaded web-page. It should be understood that a multimedia content element, such as an image or a video, may include a plurality of multimedia content elements. In S**750**, at least one signature generated for each identified multimedia content element is received by the server **130**. The signatures for the multimedia content elements are generated by the SGS **140** as described in greater detail above.

In S**760**, respective of each signature, the context of the multimedia content element is determined. The determination of context based on the signatures is discussed in more detail hereinabove with respect of FIG. **5**. In S**770**, respective of the context or the signature of the elements, one or more contextual filters to the one or more multimedia content elements are generated. The process of generating a contextual filter is discussed herein below with respect to FIG. **8**.

The one or more contextual filters may be extracted from the data warehouse **160**. The contextual filters enable editing of the context of the multimedia content as well as editing each of the one or more elements within the multimedia content. According to an embodiment, a contextual filter may include an initial context and a final context (e.g., "sadness" and "happiness," "day" and "night," "one" and "three," etc.), an editing action to be performed on concepts of multimedia content elements respective of the initial context and final context (e.g., "change from day to night," "change from sadness to happiness," "change from one to three," etc.), as well as one or more multimedia content elements that may be provided as part of performing the editing action. According to a further embodiment, the multimedia content elements of the contextual filter may be displayed as an overlay over the multimedia content. As an example, a contextual filter may enable changing of the expression of a person's face showing in an image. As another example, the background of an image may be changed as well as time of the day—from morning to night, etc.

As an exemplary and non-limiting example of contextual filter utilization, an image featuring a frowning child standing in front of a rainy background is received. Respective of this image, the server determines that the context of the image is "sadness," and then generates a contextual filter of "change from sadness to happiness." Images featuring a smile and a sunny background, concepts that are indexed with the context "happiness," are provided by the contextual filter and added to the image as overlays, thereby changing the image to one of a smiling child standing in front of a sunny background.

As another non-limiting example of an embodiment, an image featuring a fish on the sand of a beach is received. Respective of this image, the server determines that the context of the image is "fish out of water" and then generates the contextual filters of "change from one to three" and "change from dry land to ocean." Images featuring three fish and a water background, related to the concepts "three" for fish and "ocean" are provided by their respective contextual filters and added to the image as overlays, thereby changing the image to one of three fish in the ocean.

The one or more contextual filters can be sent directly to the web browser executed by user device **120-1** requesting the web-page. This requires establishing a data session between the context server **130** and the web browsers executed by user devices **120**. In another embodiment, the one or more contextual filters are returned to a web server (e.g., information source **150**) hosting the requested web-page. The web server returns the requested web-page with the multimedia element containing the contextual filters. In S**780**, it is checked whether the one or more multimedia content elements contained in the web-page has changed, and if so, execution continues with S740; otherwise, execution terminates.

As a non-limiting example, a web-page containing an image is uploaded to the server **130**. Signatures are then generated by the SGS **140** respective of a person smiling and the background of the image, which is The Dam Square in Amsterdam. A contextual filter is generated and displayed as an overlay over the image. The contextual filter allows changing the user's expression from smiling to crying.

The web-page may contain a number of multimedia content elements; however, in some instances only a few contextual filters may be displayed in the web-page. Accordingly, in one embodiment, the signatures generated for the multimedia content elements are clustered and the cluster of signatures is matched to one or more advertisement items.

FIG. **8** depicts an exemplary flowchart demonstrating the process S**770** for generating contextual filters according to an embodiment. In S**810**, a context and a request to filter the context are received. In S**820**, at least one signature is generated for the context. Further discussion of the signature generation process is discussed hereinabove with respect to FIGS. **3** and **4**. In an embodiment, this signature may be the signature of one of the multimedia content elements representing a concept associated with the context. In another embodiment, this signature may include a portion of the signature of a multimedia content element that demonstrates a high level of matching with a portion of another multimedia content element associated with the context.

In S**825**, potential contextual filters are retrieved from a data warehouse, for example, respective of the context signatures. Potential contextual filters may be, but are not limited to, contextual filters stored in the data warehouse. A potential contextual filter is associated with an initial context that includes multimedia content elements and/or signatures associated with the context of portions of multimedia content that the filter is designed to change. The potential contextual filter is also associated with a final context that includes multimedia content elements and/or signatures associated with the context of the desired overlays for the multimedia content. Additionally, the potential contextual filter contains multimedia content elements associated with the final context. Such multimedia content elements will be provided as overlays if the filter is selected for use. Potential contextual filters are selected to be applied if the signature of its initial context demonstrates a sufficient level of matching with the signatures of a multimedia content element's context.

As a non-limiting example, a potential contextual filter may contain an initial context including a signature associated with the concept "clouds." The potential contextual filter would also contain a final context including a signature associated with a second concept such as "sunshine." When the potential contextual filter is applied, multimedia content elements associated with the second concept (e.g., the sun, clear blue skies, and the like) are overlaid on portions of the original multimedia content featuring signatures representing the concept "clouds." As a result, a portion of an image containing a cloudy sky may be overlaid with images of the sun and clear blue skies.

In S**830**, a signature is generated for an initial context associated with each potential contextual filter. In an embodiment, this signature may be the signature of one of the multimedia content elements representing a concept associated with the context. In another embodiment, this signature may include a portion of the signature of a multimedia content element that demonstrates a high level of matching with a portion of another multimedia content element associated with the context.

In S**840**, a signature matching process is performed between the signature generated for the context in S**820** and each signature of the initial context produced in S**830**. Two signatures are considered matching if they overlap other over a predefined threshold. A signature of an initial context that demonstrates the highest rate of matching among the analyzed initial contexts is then identified as a closest matching initial context. In S**850**, the potential contextual filter corresponding to the closest matching initial context is provided as the contextual filter for the input context. The contextual filter may be retrieved from a data warehouse (e.g., data warehouse **160**).

The various embodiments disclosed herein can be implemented as hardware, firmware, software, or any combination thereof. Moreover, the software is preferably implemented as an application program tangibly embodied on a program storage unit or computer readable medium consisting of parts, or of certain devices and/or a combination of devices. The application program may be uploaded to, and executed by, a machine comprising any suitable architecture. Preferably, the machine is implemented on a computer platform having hardware such as one or more central processing units ("CPUs"), a memory, and input/output interfaces. The computer platform may also include an operating system and microinstruction code. The various processes and functions described herein may be either part of the microinstruction code or part of the application program, or any combination thereof, which may be executed by a CPU, whether or not such a computer or processor is explicitly shown. In addition, various other peripheral units may be connected to the computer platform such as an additional data storage unit and a printing unit. Furthermore, a non-transitory computer readable medium is any computer readable medium except for a transitory propagating signal.

All examples and conditional language recited herein are intended for pedagogical purposes to aid the reader in understanding the principles of the invention and the concepts contributed by the inventor to furthering the art, and are to be construed as being without limitation to such specifically recited examples and conditions. Moreover, all statements herein reciting principles, aspects, and embodiments of the invention, as well as specific examples thereof, are intended to encompass both structural and functional equivalents thereof. Additionally, it is intended that such equivalents include both currently known equivalents as well as equivalents developed in the future, i.e., any elements developed that perform the same function, regardless of structure.

What is claimed is:

1. A method for providing contextual filters respective of an identified context of a plurality of multimedia content elements, comprising:

receiving the plurality of multimedia content elements;

generating at least one signature for each of the plurality of multimedia content elements; wherein the at least one signature of a multimedia content element of the plurality of multimedia content elements represents a response of one or more neural networks to the multimedia content element;

generating a plurality of concepts based on each of the plurality of multimedia content elements, wherein each concept of the plurality of concepts is an abstract description of the multimedia content element which the at least one respective signature was generated;

determining a context of each of the plurality of multimedia content elements based on the plurality of concepts generated based on the each of the plurality of concepts, wherein a context of a multimedia content element is determined as the correlation among the plurality of concepts generated based on the multimedia content element; and

providing at least one contextual filter with respect to the context of each of the plurality of multimedia content elements.

2. The method of claim **1**, wherein the at least one contextual filter enables at least one of: editing of the context of the multimedia content element and editing of the content of each of the plurality of multimedia content elements.

3. The method of claim **1**, wherein receiving the plurality of multimedia content elements further comprises: receiving a uniform resource locator (URL) of a web-page; downloading the web-page based on the received URL; and analyzing the web-page to identify the existence of each of the plurality of multimedia content elements.

4. The method of claim **1**, further comprising: storing in a data warehouse the determined contexts and the at least one contextual filter.

5. The method of claim **3**, wherein providing the at least one contextual filter with respect to the context of each of the plurality of multimedia content elements further comprises: generating a signature for the determined context; retrieving potential contextual filters from a data warehouse; generating a signature for an initial context of each of the retrieved potential contextual filters; performing signature matching between the signature of the context and the signature generated for each initial context to identify a closest matching initial context; and determining the contextual filter to the potential contextual filter respective of the closest matching initial context.

6. The method of claim **4**, further comprising: identifying one or more portions of multimedia content in each of the plurality of multimedia content elements; generating at least one signature for each of the identified portions; analyzing the at least one signature using at least one previously generated signature maintained in the data warehouse; determining the context of the multimedia content element based on the signatures and the analysis; and generating at least one contextual filter with respect to the context of the multimedia content element and based on the signatures and the analysis.

7. The method of claim **1**, wherein the at least one signature is robust to noise and distortion.

8. The method of claim **1**, wherein each of the plurality of multimedia content elements is at least one of: an image, graphics, a video stream, a video clip, an audio stream, an audio clip, a video frame, a photograph, images of signals, and portions thereof.

9. The method of claim **1**, wherein the correlation among the plurality of concepts is performed using a probabilistic model.

10. The method of claim **1**, wherein the correlation among the plurality of concepts is based on sizes of signatures representing the concepts.

11. The method of claim **1**, wherein the correlation among the plurality of concepts is based on spatial locations of each signature representing a concept.

12. The method according to claim **1** comprising generating the at least one signature for each of the plurality of multimedia content elements by a plurality of mutually independent computational cores that comprise the one or more neural networks.

13. The method according to claim **1** comprising:

receiving a request to edit a context of a multimedia content element, by applying a contextual filter related to the multimedia content element, and

modifying the multimedia content element by applying the a contextual filter related to the multimedia content element.

14. The method according to claim **13** wherein the modifying comprises changing a context of the multimedia content element from an initial content to a final context.

15. The method according to claim **13** wherein the modifying comprises overlaying a multimedia content element associated with the final context over a multimedia content element associated with the initial context.

16. A non-transitory computer readable medium having stored thereon instructions for causing one or more processing units to execute a process for providing contextual filters respective of an identified context of a plurality of multimedia content elements, the process comprising:

receiving the plurality of multimedia content elements;

generating at least one signature for each of the plurality of multimedia content elements; wherein the at least one signature of a multimedia content element of the plurality of multimedia content elements represents a response of one or more neural networks to the multimedia content element;

generating a plurality of concepts based on each of the plurality of multimedia content elements, wherein each concept of the plurality of concepts is an abstract description of the multimedia content element which the at least one respective signature was generated;

determining a context of each of the plurality of multimedia content elements based on the plurality of concepts generated based on the each of the plurality of concepts, wherein a context of a multimedia content element is determined as the correlation among the plurality of concepts generated based on the multimedia content element; and

providing at least one contextual filter with respect to the context of each of the plurality of multimedia content elements.

17. A system for providing contextual filters respective of an identified context of a plurality of multimedia content elements, comprising: a network interface for receiving a plurality of multimedia content elements; a processor; and a memory coupled to the processor, the memory contains instructions that when executed by the processor cause the system to:

generate at least one signature for each of the plurality of multimedia content elements; wherein the at least one signature of a multimedia content element of the plurality of multimedia content elements represents a response of one or more neural networks to the multimedia content element;

generate a plurality of concepts based on each of the plurality of multimedia content elements, wherein each concept of the plurality of concepts is an abstract description of the multimedia content element which the at least one respective signature was generated;

determine a context of each of the plurality of multimedia content elements based on the plurality of concepts generated based on the each of the plurality of concepts, wherein a context of a multimedia content element is determined as the correlation among the plurality of concepts generated based on the multimedia content element; and

provide at least one contextual filter with respect to the context of each of the plurality of multimedia content elements.

18. The system of claim **17**, wherein the at least one contextual filter enables at least one of: editing of the context of the multimedia content element and editing of the content of each of the plurality of multimedia content elements.

19. The system of claim **18**, wherein the system is further configured to: generate a signature for the determined context; retrieve potential contextual filters from a data warehouse; generate a signature for an initial context of each of the retrieved potential contextual filters; perform signature matching between the signature of the context and the signature generated for each initial context to identify a closest matching initial context; and determine the contextual filter to the potential contextual filter respective of the closest matching initial context.

20. The system of claim **17**, wherein the system is further configured to: receive a uniform resource locator (URL) of the web-page; download the web-page based on the received URL; and analyze the web-page to identify the existence of each of the plurality of multimedia content elements.

21. The system of claim **17**, wherein the system is further configured to: store in a data warehouse the determined contexts and the at least one contextual filter.

22. The system of claim **17**, wherein the system is further configured to: identify one or more portions of multimedia content in each of the plurality of multimedia content elements; generate at least one signature for each of the identified portions; analyze the at least one signature using at least one previously generated signature maintained in the data warehouse; determine the context of the multimedia content element based on the signatures and the analysis; and generate at least one contextual filter with respect to the context of the multimedia content element and based on the signatures and the analysis.

23. The system of claim **17**, wherein the at least one signature is robust to noise and distortion.

24. The system of claim **17**, wherein each of the plurality of multimedia content elements is at least one of: an image, graphics, a video stream, a video clip, an audio stream, an audio clip, a video frame, a photograph, images of signals, combinations thereof, and portions thereof.

* * * * *